An Introduction to Popper's Scientific Method

The Realm of Conjectures and Refutations

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(An Introduction to Popper's Scientific Method)

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Preface

My interest in philosophy of science was kindled while I was working on Popper's socio-political ideas for my Ph.D. thesis. The candour and logical power of his ideas on the philosophy and methodology of science arrested my attention. Inspite of being simple, the argument is technical on some points. In this book, I have simplified those technical aspects and have thus tried to present them as lucidly and systematically as possible. Hope they become intelligible to the general reader.

I sincerely thank my publisher for his promptness and efficiency.

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To my mother

.... whose love I have always taken for granted.

CONTENT

INTRODUCTION

Among twentieth century philosophers Sir Karl Popper has been rightly acclaimed as the most influential philosopher of science. Many practicing scientists have admitted the influence of Popper on their methods. Yet he also happens to be the most controversial philosopher of science. His ideas on scientific method have come under severe criticism. Nevertheless, it cannot be denied that his is a classic statement of intellectual freedom as it is embodied in the rationality of science. Popper may not have said the last word on the method and philosophy of science, but he certainly has a point to make. He has stated some obvious facts about scientific methodology and drawn some inevitable conclusions from them. And once they have been stated, the correctness and logical force even of his obvious arguments can hardly be ignored. Either they have to be accepted or they have to be criticised but they simply cannot be rejected or ignored by any serious student of the subject. It is no exaggeration that much quality writing today in philosophy of science is either in acceptance or in criticism of Popper. The criticisms, no doubt, have been too many and too severe, and they have almost wrecked the Popperian position. But, as T.E. Burke puts it beautifully, '....even if sustained criticism ultimately wrecks the distinatively Popperian conception of science, it is likely still to endure as one of those wrecks that mark the channel through which all later research must pass and in the long term, perhaps, no philosophical theory can hope for a better fate than that.'[1]

The same is true of Popper's socio-political ideas as well but this book limits itself to his scientific or technical ideas alone. Yet the two are inter connected. Freedom—intellectual and moral—is central to the Popperian perspective and science is central to the meaning of freedom.

Freedom in the Popperian perspective, is central to human affairs and science is central to the meaning of freedom. In fact, freedom is writ large in the methodology of science. But the reason why freedom is rooted in scientific method is because it dwells in the very foundations of man's knowledge-seeking endeavour; and

1. Burke, T.E., The Philosophy of Popper, Preface, viii.

scientific method is nothing but a distilled form of the process of acquiring knowledge. Thus, the nature and process of knowledge essentially originates in man's freedom to know. Therefore, epistemology is the starting point and the *raison d' etre* of Popper's ideas. However, the vantage point of epistemology itself is decided by Popper's metaphysical position. Metaphysics and epistemology set the ground for Popper's scientific method. They are dealt with in part I of this book.

Popper's is the philosophy of realism. It takes as its subject matter the objective, commonsensical everyday world of sense-experience. Yet, to this world he brings another metaphysical position of criticizability which makes all the difference. Criticizability means that no philosophy, no idea and no government is above censorship. To be able to criticize is to be free, and being free means having a dignified human existence. By grounding it into criticizability Popper's realism becomes man-centric. It also explains Popper's admiration for the primordial critical spirit of the pre-Socratics and their glorious tradition of free thought.

Yet, this world is not only commonsensical and arguable (criticizable), it is creative and rational too. All ethics, art, literature, philosophy and science, *i.e.*, Popper's world 3[1] partake in these two attributes. Since it recognizes human rationality and creativity (or emergence of novelty), Popper's world view presumes indeterminism and human freedom which inevitably flow from them.

Nature too is creative. That is why Popper hails Darwin's theory of Natural Selection as a very epoch-making theory. For it removes the myth of divine interference and conceives evolution as a miraculous unfolding of the creativity and rationality inherent in nature. The beauty and charm of the world lies in its novelty (which is something unpredictable and indefinite). Yet its orderliness and purposefulness lies in its rationality which controls that novelty. Thus, the world for Popper is governed by the philosophy of indeterminism; Human freedom stems from this essential meaning of the world since the latter exudes the combination of chance and reason.[2] In fact, the chord of reason binds everything in Popper.

It brings purposefulness in the chance like nature of the

1. World 1. The natural world, World 2. The man made physical world in Popper.
2. This idea is dealt with in sections 5 and 6 of Part I.

universe, and with it a whole new world of plans, intentions, deliberations, decisions and values spring forth. It connects man with nature, and above all, it connects man with man. Criticizability is yet another form of this abiding force of rationality. For, it is the element of rationality that makes anybody's theory liable to be criticized by any other person. Popper considers himself a rationalist but as a worshipper of creativity too, he accepts the label of an indeterminist for want of a better nomenclature.

Popper's epistemological position becomes clear against the backdrop of his world-view of realism criticizability and indeterminism. It enables Popper to appreciate the essential creativity and rationality embedded in the world of which human freedom is a splendid manifestation. From rationality flows the attribute of criticizability which again decides the tone and temper of the human world. For, moving by the dynamics of creativity and creativity and getting controlled by the logic of rationality (or criticizability) is the biography of the entire human world in all its glory as written by Popper.

Thus man's creative-critical freedom finds its central place in an anthropocentric, objective, rational world. Popper's theory of knowledge derives its attributes from this world. Thus, it is equally realistic, down to earth, concerned as it is with the basic problem of survival in an alien world. Its purpose is practical and pragmatic; it is egalitarian and lively too. Again, truth has a central, overarchical status in his epistemology, which determines, in turn, some of its major characteristics. There is, in it, a faith in the existence of an objective truth (ontologically) that is contrasted with the idea of the non- attainability of it methodologically. It purports that there are final truths but man can never know them as such.[1] Even if he would hit upon the truth, he would never know that he has actually found it. This assumption may appear contradictory but for Popper these important epistemological conclusions flow form it. If truth cannot be realized qua truth but if it exists objectively, man can always try to come nearer to it. His endeavours to know truth are valuable by themselves and man has an inalienable freedom to make them. Since he does not know truth and can never recognize it as one, all his attempts to know it shall forever remain conjectural. And trying to know the truth is trying to understand reality and improve one's chances of survival in it. The purpose of knowledge is therefore existential, which is the same for all human beings. They can merely make guesses

1. Popper's ideas on truth are examined in sections 8, 9, 15.

METAPHYSICS

The Oxford Dictionary defines metaphysics as 'that branch of speculation which deals with the first principles of things, including such concepts as being, substance, essence time, space, cause, identity etc.' Going by this definition it is difficult to say that there is a metaphysical basis to Popper's ideas on science and politics. But if, in a simplified form, metaphysics means, the philosophical assumptions of a philosopher, or the total world view assumed by him before tackling a problem of the world, then yes, Popper does have a metaphysics to start with.

Thus, before coming to Popper's core ideas in the theory of knowledge, philosophy of science and philosophy of politics, it is necessary to envisage the whole gamut of his ideas which have gone into their making. A very solid and logical structure is there, indeed, in Popper's edifice. It would do well if, before delving deep into it, a knowledge of its philosophical groundwork is acquired. Since Popper is not a philosopher in the traditional sense of the term, the metaphysical aspect in him is not very elaborate. But, if by metaphysics is meant a set of germaine ideas that go into the creating and shaping of a philosopher's entire thought, they are very much there in Popper. They constitute his essential standpoint, his vantage point from where he sees the whole world, selects and picks up his problems from amongst a myriad of problems. They make his *'Weltanschauung.'*

A very obvious feature of Popper's ideas is the clarity with which he derives his moral and political ideas from his epistemology. Two more philosophers who have ventured to do the same, as per Popper, are Kant and Bertrand Russell. Nevertheless, it seems that it should be the other way round. On close examination, it somehow appears convincing that it is the metaphysics of a philosopher that serves as the matrix of his epistemology, his social and political ideas.

One is here reminded of the famous dictum of Aristotle that man is prior to State in time but 'State is prior to man' in logic. Therefore, by logic of its importance, Popper's metaphysics should

be given fundamental place while reviewing his entire work.

Before analyzing Popper's metaphysics, his own view on it should be known.

The Role of Philosophy in Popper's View.

Philosophers have different views regarding the actual purpose of philosophy in man's inventory of knowledge. For Socrates, philosophy was a rational tool for knowing the world and oneself, Wittgenstein attributes to it the purpose of describing any activity, of laying bare all the presuppositions implicit in a given activity. It is like making the doer self-conscious of the methods adopted by him quite unknowingly. Wittgenstein was of the idea that this frank description itself becomes the best explanation of an activity.

Popper's ideas are quite different. According to him the only meaningful purpose that can sustain philosophical inquiry is one of solving problems emerging outside philosophy, *i.e.*, in the realms of science, mathematics, politics, culture, morals and religion. Philosophy is not a self-sufficient activity. Its a method of analysis and explication but its focus should turn outwards. The moment it ceases to take interest in some genuine social, human or intellectual problem outside itself, it starts degenerating. Philosophyzing for its own sake is a meaningless and pseudo activity.

Popper's own philosophy is true to its word. His political and ethical ideas are an effort to grasp the danger to individual freedom from Russian totalitarianism and to hold it at bay with his advocacy of democracy and the ideas of piecemeal social engineering.

Criticizability : Popper's concept of Philosophy.

As declared by Popper in his essay, Metaphysics and Criticizability, his own philosophical position combines indeterminism, realism and rationalism. These will be discussed later. However, Popper raises a more basic question at the outset : In the vast storehouse of knowledge, how can its genuine and ingenuine specimens be separated? or rather put in a slightly different manner, it can be said that Popper believes in testability and criticizability as the hallmarks of true knowledge, testability of genuine scientific theories, and criticizability of genuine philosophical ones. Indeed, the specific trait of testability gets

amplified into a philosophy of criticizability, or rather the criterion of criticism gets empirically translated into attempted tests or refutations of a scientific theory. Popper's philosophy of criticism may very rightly be understood as the philosophy of common sense which Popper finds in Aristotle and Socrates and of which he is a great admirer. Of course, this philosophy shouldn't be confused with, what Popper terms, as the common sense or bucket theory of knowledge—a theory termed by him as a blunder in the epistemological history of the West. Popper's philosophy of common sense or criticizability will be dealt with in this section however, his criticism of the common sense theory of knowledge will be discussed in the section on his epistemology.

To begin with, refutability (testability) or criticizability is, according to Popper, the criterion of genuine science and philosophy. Refutability or testability vis-a-vis science is broadly speaking, criticizability vis-a-vis philosophy. However, they can be only broadly similar because philosophical theories are not terminally refutable like empirical theories.

This idea of testability brings in its wake, some interesting concepts of truth and falsehood. It is Popper's basic notion that no science, no philosophy, and no knowledge can be totally true or correct, for truth cannot be known once for all. It is more of an ideal which can only be approximated more or less, but never attained fully. Theories can be nearer or farther from truth. But the irony which Popper admits is that the truth-content of theories cannot be judged by confirming them (This is why induction is a futile exercise, says Popper.) It can only be judged by seeking falsification of the theory. The strange paradox emerging therefrom is : a refutable theory, *i.e.* a wronged theory is a true theory, an irrefutable one is a false theory. Wrongfulness or criticizability is the prerequisite of correctness or truth. In this way, a unique conception of truth and falsity is developed by Popper. This, however will be discussed in his philosophy of science. However, Popper admits this implausibility of his position; a rationalist that he is, he says in his essay, 'how can a rationalist say of a theory that it is false and irrefutable? Is he not bound, as a rationalist, to refute a theory before he asserts that it is false? And conversely, is he not bound to admit that if a theory is irrefutable, it is true?[1]

However, this *prima facie* contradiction is resolved in Popper's subsequent exposition of his ideas. A pure existential statement is

1. Popper : Conjectures and Refutations, page 195.

the simplest example of an empirically. One example of such a statement : 'There exists a pearl which is ten times larger than the next largest pearl.'[1] This statement is a purely existential one because it applies to the whole universe and it is irrefutable because there can be no method by which it could be refuted. Even if we were to search the entire universe, our failure to find one such pearl would not amount to a refutation of the statement, for there would always remain the possibility of that great pearl hiding in some nook or cranny of the vast universe. On the contrary, if the statement is restricted to some finite region or period of time, it becomes precise and is easily liable to refutation. It would then read 'At this moment and in this box here there exist at least two pearls one of which is ten times larger than the next largest pearl in the box.'[2] Now this becomes a 'restricted empirical statement'. A true scientific statement or theory is an assertion of this quality. It has to be restricted, not loose, precise, not general, liable to conclusive verification, not evading it.

In the same essay Popper gives another example of an empirically irrefutable pure existential statement, 'There exists a Latin formula which if pronounced in proper ritual manner, cures all diseases.'[3] This is a pure existential statement. People would largely discard that it is baseless and false. Nevertheless they cannot prove its falsity because it is not possible to pronounce each and every Latin formula in each and every possible ritualistic manner, and there would always remain the logical possibility of ever finding that magical Latin formula. Although we cannot prove its falsehood, our existing knowledge about diseases, speaks against its being true. In other words, even though we cannot provide a proof of its contradiction, the conjecture that such a magical Latin formula does not exist is much more reasonable and practical than the irrefutable conjecture that such a formula exists.

Whatever the irrationality of such assumptions, for nearly 2000 years philosophers have been nurturing a similar belief. They have been searching for the philosopher's stone; their failure to find one does not negate the belief itself, for such beliefs are pure existential prepositions which cannot be logically negated. It is only their veracity and usefulness that is undermined.

The reasonable conclusion is reached that such beliefs are

1. *Ibid*, pp. 195-196.
2. *Ibid.*, pp.196.
3. Popper : Conjectures and Refutation, p. 196.

virtually non-existent and their search practically futile. (It should be examined whether Popper's insistence upon practicability and workability, of theories, signifies his pragmatism and realism.)

It is by now clear that, as per Popper, empirical refutability means logical refutability, and the two synonymous attributes account for the truth of a theory. A refuted theory is a true theory, an irrefutable theory is a false theory—are the contradictory but logical assertions emerging out of the Popperian mode of inquiry. Taking a logical step further, Popper then labels all empirical or scientific theories as the refutable and true theories and all non-empirical or philosophical theories as the irrefutable and false ones.

> "Thus the logical or empirical irrefutability of a theory is certainly not a sufficient reason for holding the theory to be true, and hence I have vindicated my right to believe, at the same time, that.....philosophical theories are irrefutable, and that they are false.....[1]

In order to state this mode of inquiry more clearly and systematically, Popper distinguishes between three types of theories :[2]

> First, logical and mathematical theories.
>
> Second, empirical and scientific theories.
>
> Third, philosophical or metaphysical theories.

The question is : how can we distinguish between true and false theories in each group?

'Regarding the first group the answer is obvious. Whenever we find a mathematical theory of which we do not know whether it is true or false, we test it, first superficially and then more severely, by trying to refute it. If we are unsuccessful we then try to prove it or refute its negation. If we fail again, doubts as to the truth of the theory may have cropped up again, and we shall again try to refute it, and so on, until we either reach a decision or also shelve the problem as too difficult for us.

The situation could also be described as follows. Our task is the testing, the critical examination, of two (or more) rival theories. We solve it by trying to refute them—either the one or the other—until we come to a decision. In mathematics (but only in mathematics) such decisions are generally final : invalid proofs

1. *Ibid.*
2. *Ibid.*

that escape detection are rare.'[1]

Elaborating upon the process of refutation Popper states, 'Every serious test of a theory is an attempt to refute it. Testability is, therefore, the same as refutability, or falsifiability. And since we should call 'empirical' or 'scientific' only such theories as can be empirically tested, we may conclude that it is the possibility of an empirical refutation which distinguishes empirical or scientific theories.'[2] Thus when it comes to the empirical and scientific theories of the second group, Popper says that, 'we test our theories : we examine them critically, we try to refute them. The only important difference is that now we can also make use of empirical arguments in our critical examinations. But these empirical arguments occur only together with other critical considerations. Critical thought as such remains our main instrument. Observations are used only if they fit into our critical discussion.'[3]

'Critical thought" is an important variant added by Popper here in his criterion of testing empirical theories. It removes a major deadlock in Popper's ideas in the present context and provides an important insight into Popper's philosophy at large. The elusion here is made to his concept of problem-solving.

As has been mentioned above, Popper deems metaphysical or philosophical theories as irrefutable thus false. He states five examples of such philosophies. A notable fact about them is that they are all representative philosophies of modern times.

1. Kant's doctrine of determinism which he enunciates in his Critique of Pure Reason, as the future of the empirical world (or of the phenomenal world) is completely predetermined by its present state, down to its smallest detail.

2. Berkeley's or Schopenhauer's idealism which holds that 'the empirical world is my idea' or 'the world is my dream.'

3. Epistemological irrationalism which means that the world can be known only by such supra-rational means as instinct, poetic inspiration, moods or emotions. This post-Kantian philosophy had two important offshoots :

1. Popper : Conjectures and Refutations p. 197.
2. *Ibid*
3. *Ibid.*

4. Voluntarism : In our own volitions we know ourselves as wills. The thing-in-itself is the will.

5. Nihilism : In our boredom we know ourselves as nothings. The thing-in-itself is Nothingness.[1]

Now Popper's categorical denigration of these philosophies as non-testable and irrefutable, amounts to ostracization of philosophy itself from the community of true, meaningful discourse, since, even at the cost of repetition it can be asserted that the examples selected by Popper happen to be the best representatives of modern philosophy. This denigration is a severe judgment which, fails to appear convincing or acceptable to the enlightened minds. To make matters worse, the judgment renders Popper's own philosophy false and meaningless. Nevertheless, no way out seems within Popper's framework of salvaging philosophy. A deadlock thus appears inevitable.

Indeed Popper himself would have realized the severity of his judgment and the inevitability of a consequent deadlock. Thus being the common sense realist that he avowedly is, he has perhaps tried to remove the deadlock and, thus, pre-empt the severe implications arising therefrom, by introducing the concept of critical thought in his criterion of testing theories. It is a correct, ingenious enlargement of the narrow, limited concept of empirical testability. What is negative observational evidence at the empirical level, criticism is at the argumentative level. Criticism of a theory is, broadly speaking, testing of a theory at the discursive level. The term 'criticism' can very well share the broad meaning with testability without having to share the disadvantages of its parochial empirical overtones.

The conclusion, then, emerges that criticism is the veritable, liberal criterion of distinguishing between true and false philosophical theories in Popper. A true theory is still the testable one, but testability has now been enlarged by Popper to mean amenability to critical examination. It is no more testability in the strict sense of the word since philosophical theories are neither demonstrable nor refutable logically or empirically. The problem can be reformulated as follows :

'Is it possible to examine irrefutable philosophical theories critically? If so, what can a critical discussion of a theory consist of, if not of attempts to refute the theory?

1. Popper : Conjectures and Refutation, p. 194.

In other words, is it possible to assess an irrefutable theory rationally—which is to say, critically? And what reasonable arguments can we adduce for and against a theory which we know to be neither demonstrable nor refutable.'[1]

The only important change affected in Popper's answer here is that it is extended to cover a special category of empirical arguments as well. Popper states here very clearly that any refutable theory, whether philosophical or empirical, can be discussed or evaluated critically only if it has a rational element in itself; and it is rational only so far as it tries to solve certain problems. What Popper means to say is that a theory is rational and, therefore, understandable only in the context of a problem—situation; and it can be rationally or critically discussed only in view of its contribution to the solution of that problem.

'Now if we look upon a theory as a proposed solution to a set of problems, then the theory immediately lends itself to critical discussion even if it is non-empirical and irrefutable. For we can now ask questions such as : Does it solve the problem? Does it solve it better than other theories? Has it perhaps merely shifted the problem,? Is the solution simple? Is it fruitful? Does it perhaps contradict other philosophical theories needed for solving other problems?

Question of this kind show that a critical discussion even of irrefutable theories may well be possible.[2] In this context Popper re-examines Kant's determinism. Kant's basic philosophy was one of indeterminism; he believed fundamentally in man's moral freedom. It was only due to the phenomenal success of Newton's determinist physical theories that Kant was reluctantly led to accept cosmological determinism and thus epistemological determinism. Yet it was ironical that he could not reconcile between his own moral indeterminism and cosmological or epistemological determinism. In fact, Kant could never bridge the gap between his theoretical and practical philosophies.

Even Kant's determinism can also be rationally scrutinized. It can be examined whether it actually, *i.e.*, logically flows from Newton's determinism. It is Popper's conjecture that it does not; and had Kant also known this, he would have certainly repudiated cosmological and epistemological determinism even though he would never have been able to demonstrate or refute it logically.

1. Popper : Conjectures and Refutations p. 198.
2. *Ibid.* p. 199.

Same can be said about Hume's irrationalism too. Hume was a rare rationalist. The thread bare logic with which he unveiled the fallacy inherent in induction was synonymous for a revolution in the West's intellectual history. Why then did such a glorious rationalist kneel down to irrationalism? Where was the compulsion for him to denigrate his rationalism with a touch of useless irrationalism? Of course in Hume's rationalist structure, irrationalism is uncalled for. But where was the need for this needless grafting for a philosopher of Hume's stature? This enigma cannot be resolved only by analysing Hume's philosophy. The latter needs to be transcended; the problem situation has to be understood, one that dominated Hume's psychology. Broadly speaking, it is always history which is the solvent of philosophical enigmas and contradictions.

Thus, accepting induction for the sake of psychology, even after firing it logically, and thereby hailing habits and expectations as determinants of learning is the irrationalism in Hume. History explains that Hume, like Kant, was also under the spell of the unprecedented success of Newton's physics—a success which could only be epistemologically attributed to the Baconian method of induction. Newton's victory was victory for induction and philosophical determinism in other words. And this victory was a gigantic wave that severely shook the indeterminist conviction of Kant and the rationalist convictions of Hume. Perhaps half heartedly, both the brilliant philosophers had to effect a patchwork on their equally brilliant philosophies. Fortunately enough, their efforts remained patchworks and they in turn, retained their intellectual integrity unto the last. Kant could not synthesize his grafted cosmic and methodological determinism with his moral indeterminism. Thus, there remain two polarities of his philosophy. However, now with quantum physics at our side, we can say that determinism, whether cosmological or methodological, is untenable and there was no need for Kant to accommodate it with his own sound indeterministic moral philosophy.

And if irrationalism entered into philosophy with Hume, those who have read him, says Popper, would agree that it was not an entry Hume very much wanted. The calm analyst that Hume was, irrationalism was an unintended consequence of his accepting induction as the only mode of human learning. But even after recognizing it, Hume, as I have mentioned above, retained his intellectual integrity by refusing to justify induction on rational

grounds. Popper says, 'So much the worse for rational justification was a conclusion which Hume, of necessity, was compelled to draw from this situation. He accepted this conclusion with the honesty characteristic of a real rationalist who does not shrink from an unpleasant conclusion it seems to him unavoidable.'[1]

Yet Hume's conclusion was not unavoidable because his problem was not unavoidable; it was virtually non-existent. Men, women are not inductive learning machines as Bacon imagined and Hume expected them to be. As proves the life-time endeavour of Popper's, habits and expectations don't play that seminal role in the process of human understanding as has been traditionally conceived; that the seminality is, conversely, of rational criticism. Popper's conception of understanding is very much in tune with Hume's rationalism. If the former is accepted, Hume's problem disappears and with it disappears the need for his irrationalism too.

The genesis of Kant's and Hume's problems and their subsequent solutions give some important insight in the nature of philosophical theories.

Every philosophy is an answer to some question or problem-situation outside itself. Philosophical theories become comprehensible only when viewed critically in the light of that problem. This is the situational rationality or logic of philosophical discourse. This means that its rationality or meaning cannot be grasped in isolation; it unfolds only when viewed vis-a-vis a problematic context *i.e.* intellectual situation in history. This virtue of problem-solving is the inherent rationality of genuine philosophical theories, otherwise they are neither demonstrable nor refutable empirically. This inherent rationality or logic makes them eternally re-examinable and re-appraisable. In other words, philosophical endeavours are open-ended affairs. They are amenable, *ad infinitum*, to critical evaluation, *i.e.*, their problems can always be reformulated, and the soundness, the viability of their solutions can always be reassertained. The re-examination and re- assessment may come from very humble or very venerated minds. Its not the source but the merit of the questions raised that is important; not the status of the examiner but the quality of examination that is of value. This merit or this quality is determined by the fact that the problem has been understood in its totality, its real nature, its magnitude and urgency have been

1. Popper : Conjectures and Refutations p. 200.

rightly understood, each of its various underlying implications have been unravelled, the various solutions have been suggested, and judged comparatively and the best solution selected thereafter. Popper describes this situation in the following words :

> 'The discovery of a problem can be something final; it is made once and for all time. But the solution of a philosophical problem is never final. It cannot be based upon a final proof or upon a final refutation : this is the consequence of the irrefutability of philosophical theories. Nor can the solution be based upon the magical formulae of inspired (or bored) philosophical prophets. Yet it may be based upon the conscientions and critical examination of a problem-situation and its underlying assumptions, and of the various possible ways of resolving it.[1] HOwever, one tends to disagree with the first two lines of the above quoted passage in view of Popper's critical evaluation of Kant's and Hume's problems. What Popper suggests therein is that the two philosophies, inspite of their own brilliance, came up with faulty answers only because they misunderstood the problems of their own times. This is why one has to deviate from Popper's intent and state that neither the comprehension of the problem, nor the selection of answers is final in philosophy, both of them are equally open-ended.

Thus it can be concluded that criticizability is one variant in Popper's metaphysical position. In science this means empirical refutation of theories and in mathematics, logical refutation of problems. In philosophy, however, it means discovering the historical problem-situation which it purports to solve, and its relative success vis-a-vis other contemporary theories in solving it. Initially, owing to his narrow definition of refutability, Popper rejected philosophy as an area worthy of consideration. But then, presumably after considering the devastating implication this would have for philosophy in general, including his own, probably as an after thought, Popper seems to have enlarged the scope of his criterion so as to include historical problem-solving as well. Burke says that this problem-solving attitude is a major trait of Popper's philosophy and assumes the proportions of a paradigm namely, the crisis response paradigm. Burke hails this paradigm as a key to the understanding of the philosopher himself.

Lastly, as is established by Popper's socio-political ideas,

1. Popper Conjectures and Refutations p. 200.

criticizability, besides being an epistemological virtue, is a moral and political imperative too. It is a watchword against moral unfreedom and political authoritarianism. It imparts an immunity against strangulation of freedom and pluralism in society. Thus, criticizability of human thought, word and deed is, rightly speaking, integral to the Popperian Weltanschauung. It signifies that no knowledge and no policy meant for ordinary mortals is above the consorship wielded by those mortals. Every idea, every action in society has to withstand criticism. Any exception to this norm portends danger to man and his society. It should be fought tooth and nail. And lastly, this Popperian Weltanschauung implies that this questioning zeal, this spirit of inquiry is the ecology for man's dignified survival, and should, therefore, be protected and nurtured at 'all costs'. This explains Popper's admiration for the primordial inquisitiveness of the Presocratics. Their glorious tradition of free thought finds an intrinsic place in Popper's metaphysics, and shall be dealt with later.

Realism.

If rational criticism is one variant of Popper's world view, realism is another. As has been mentioned earlier, Popper calls himself a realist. It is quite rightly so. The simplicity, directness and candour of his ideas can emanate only from the bedrock of realism. This philosophy, says he, is essential to common sense or enlightened common sense that distinguishes between appearance and reality. But enlightened common sense does not stop here only. It rather recognizes the truth of appearances, (such as a reflection in a looking glass); it doesn't discard them as fake, as is generally presumed in such distinctions. It admits that there can be a surface reality—an appearance—and a depth reality. Another feature of Popper's realism is that it is an acknowledgment of the simple everyday world of numerous sensible and non-sensible realities. This world is, for Popper, the 'many-sorted universe', examples of which range from foodstuffs, stones, humans, trees to 'a toothache, a word, a language, a highway code, a novel, a governmental decision, a valid or invalid proof; perhaps forces, fields of forces, propensities, structures and regularities'.[1]

Popper's thesis is that realism, like other philosophies is neither demonstrable nor refutable. Yet it is arguable. And the arguments in its favour are many, which, according to Popper, can

1. Popper : Objective Knowledge, p. 31 infra.

very well be treated as potent arguments against idealism and all subjectivist epistemologies such as, positivism, phenomenalism and phenomenology.

The first strongest pro-realist argument is that, Popper says, it is a commonsensical philosophy. His exposition of it further suggests that it is the simplest, most obvious, spontaneous and the easiest of all philosophies. Unfortunately, most of the times it is grossly confused with the common sense or bucket theory of knowledge and wrongfully criticized. Popper's ideas on this fallacious theory are stated in the section on his epistemology. Secondly, all science implies realism. Some even talk of scientific realism, but because of its apparent lack of testability, Popper calls it metaphysical realism. However, science presumes or implies realism in the sense that it attempts to describe and so far as possible explain reality. It deals so with the help of conjectural theories; theories which are only probably true not certainly true, since their truth cannot be logically established. Nevertheless, by way of systematic correction they tend progressively to come nearer to the truth. By truth here is meant true description of certain facts or aspects of reality. Thus increasingly truer descriptions of reality is the purpose of science.

Language is another very good example of realism. Description, argumentation are inherent attributes of human language. An unambiguous description is *ipso facto* realistic. In fact, rationality, language, description, arguments are all about reality and presume an audience.

Idealism, on the other hand, says Popper, is absurd because it lays too much stress on subjectivity. Subjectivity, only on its own, doesn't help us much in knowing reality. It tells us more about the psychology of the knower than about the nature of reality. All objective knowledge, for Popper, consists of dispositions to act. This is a kind of tentative adaptation to reality. It is only in this limited sense that subjectivity relates to objective reality. Yet in a broader sense, its very raison *d'etre* depends upon the objective reality, since the whole question of truth and falsity of our opinions and theories becomes pointless if there is no reality, only dreams and illusions.

Thus, in conclusion, if all philosophical theories are mere conjectures, realism is the most basic and sensible of them all. All other theories, or metaphysical conjectures as they may be rightly called, are, according to Popper, mere subjectivist epistemological

arguments which lack the objectivity of realism. These theories are : positivism, idealism, phenomenalism and phenomenology. Popper considers these theories defective not only because they are subjective but because they pursue a mistaken epistemological goal of certainty or truth. In fact, in their pursuit all of them presume the fallacious common sense theory of knowledge which identifies the quest of knowledge with the attainment of truth. The idea of truth in Popper's epistemology and philosophy of science is very vital and shall be discussed later. However, so far as the common sense theory of knowledge is concerned, Popper rejects it because it does not stand upto any serious criticism.

Lastly, Popper concludes his advocacy of realism by quoting similar ideas and arguments from Albert Einstein and Winston Churchill. Popper regards them as the greatest minds of our times. He quotes Einstein as saying, 'I do not see any "metaphysical danger" in our acceptance of things—that is, of the objects of physics.....together with the spatiotemporal structures which pertain to them.'[1]

Winston Churchill's views are very characteristic on the independent existence of the sensible world. He says that apart from our physical senses, there are methods of testing the reality of the sum. The astronomers predict on the basis of pure reason or mathematics that a black spot will pass across the sun on a certain date. Our senses bear testimony to the correctness of the prediction; this is tantamount to what is called in military map-making ' a cross-bearing'. Moreover, the astronomer's calculations are 'obtained by automatic calculating-machines set in motion by the light falling upon them without admixture of the human senses at any stage.....I reaffirm with emphasis.....that the sun is real, and also that is is hot—in fact as hot as Hell, and that if the metaphysicians doubt it they should go there and see.....[2]

Churchill's is a valid criticism of all idealist and subjectivist arguments and the most ingenious argument against subjectivist epistemologies. Yet, it is only a remarkable refutation of subjectivism, it does not prove realism. One premise of idealism can still not be met, that the idealist is dreaming the debate with

1. A Einstein, 'Remarks on Bertrand Russell's theory of Knowledge, pp. 277-91. The Philosophy of Bertrand Russell, 1944; A. Schilpp, editor.
2. W.S. Churchill, My Early Life : A Roving Commission, 1930, 1947, Chapter IX, pp. 115 f.

calculating machines and all. But then, this can never be met because of its universal applicability. It is an example of what Popper calls, existential pure statements. Such statements are meaningless, as Popper has made amply clear in the previous section. He, therefore, consciously ignores idealism and subjectivism in his subsequent discussions.

Cosmology and Change.
(The Anti-Baconian Conclusion of the Pre-Socratic story).

If Popper's philosophy is one of realism, and if this realism is neither demonstrable nor refutable, only criticizable, its criticizability lies in evaluating it in view of the solutions it purports to give to its problems. This criticizability is the rationality of philosophical theories, their eternal meaningfulness, as I have asserted in the previous section. Due to this quality, they can be reviewed by anyone, anytime; they can be corrected, even dropped and replaced by theories with better solutions. Popper enunciates the logical side of his assertion in his epistemology and in greater detail, in his philosophy of science. Moreover, to prove that these assertions are not only his personal predilections but deserve to be recognized as well substantiated facts of history, he finds the story of the Presocratics highly relevant. Some of the presocratics are individually famous for their contributions to philosophy, but the significance of the entire tradition in understanding the nature of knowledge has been unwisely ignored or forgotten. Perhaps the overwhelming influence of Baconian myths have been responsible for such errors.

The story of the Presocratics and its implications are stated by Popper in his essay, Back to the Presocratics, figuring in chapter 5 of his Conjectures and Refutations. This story confirms four major premises of Popper's theory of knowledge : firstly, that the quest for knowledge in the West started with bold cosmological or cosmogonical conjectures; secondly, it improved itself critically, *i.e.*, through rationally better theories and thirdly, speculation and refutability are an integral part of scientific inquiry and that highly speculative and false theories have a greater role to play in the growth of science than less imaginative and true theories. Since the story favours some of the basic premises of Popper's epistemology, it *ipso facto* undermines some equally vital presumptions of the Baconian theory of knowledge of which the philosopher (Popper) is the arc-critic. However, these three major pro-Popper thrusts of

the story, along with their various implications shall be dealt with one after the other.

To start with, the first and foremost suggestion of the Presocratics tradition is that the quest for knowledge in the West started with bold conjectures about the nature and the origin of the world. It did not therefore start with simple queries about the nature of our observation of an orange as Bacon would make us believe. Popper says,

'Traditional empiricist epistemology and the traditional historiography of science are both deeply influenced by the Baconian myth that all science starts from observation and then slowly and cautiously proceeds to theories. That the facts are very different can be learnt from studying the early Presocratics. Here we find bold and fascinating ideas, some of which are strange and even staggering anticipations of modern results, ...most of them, and the best of them, have nothing to do with observation.'[1]

The second suggestion is that knowledge, by its very nature, is incremental and self-critical. The Presocratics proceeded towards progressively better cosmological theories by sheer dint of rationally criticising the previous theory and suggesting a logically superior alternative theory in its place. Thus, their knowledge advanced through the dynamic process of constructive criticism and not through blind entrenchment of theories by repeated unimaginative confirmations of them.

Thirdly, most of their theories were largely speculations with very little observational content (in them?) It is Popper's conjecture that Anaximander presented his own theory of the free suspension of earth as a criticism of Thales's, his teacher's theory of the earth being supported by water. According to Anaximander, 'The earth.....is held up by nothing but remains stationary owing to the fact that it is equally distant from all other things. Its shape is.....like that of a drum.....We walk on one of its flat surfaces, while the other is one the opposite side.'[2] This is a highly intuitive theory. The drum, of course, is an observational analogy, otherwise the theory is hardly observational; it is rather counter-observational. And the curious fact is that it is the intuitive part which brings the theory nearer to the truth than the observational or empirical part. However, a pupil of Bacon may say, comments Popper, that this is precisely why Anaximander was

1. Popper : Conjectures and Refutations, p. 137.
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not a scientist. 'This is precisely why we speak of early Greek philosophy rather than of early Greek science. Philosophy is speculative, everybody knows this. And everybody knows, science begins only when the speculative method is replaced by the observational method, and when deduction is replaced by induction.'[1] Yet the early Greek philosophy potentially contains or what Popper says, 'anticipates', some well-accepted empirical theories of modern times. A strong continuity is, in this way, suggested between the theories of the Presocratics and modern physics. Whether they are called philosophers, or pre-scientists or scientists matters very little, says Popper. Nevertheless, he does say this assertively that, 'Anaximander's is one of the boldest, most revolutionary, and most portentous ideas in the whole history of human thought.....It paved the way for the theories of Aristarchus, Copernicus, Kepler and Galileo.....But the step taken by Anaximander was even more difficult and audacious than the one taken by Aristarchus and Copernicus. To envisage the earth as freely poised in mid space, and to say 'that it remains motionless because of its equidistance or equilibrium' (as Aristotle paraphrases Anaximander), is to anticipate to some extent even Newton's idea of immaterial and invisible gravitational forces.'[2] Yet, even after acknowledging Anaximander's seminal historical contribution, Popper does not fail to eulogise his theory as, 'valuable in itself, like a work of art.'

The Baconian presumption, thus, stands refuted that philosophy means only speculation and the distinctiveness and the ensuing reliability of science lies in its predominantly observational character.

Moreover, it is interesting to note that a portentous theory like the one by Anaximander is also a false theory. Neither the shape of the earth is like a drum nor is it at an equidistance from sun, moon and planets. Yet we see that a speculative and false theory has engendered extremely significant scientific theories, whereas one time well-accepted true theories have now been believed to be false by the scientific community. (An example is the theory that the typical chemical properties of hydrogen belong only to one kind of atom—the brightest of all atoms.) Popper thus says, 'A false theory may be as great an achievement as a true one. And many false theories have been more helpful in our search for

1. Popper : Conjectures and Refutations, p. 138.
2. *Ibid.*

truth than some less interesting theories which are still accepted. For false theories can be helpful in many ways; they may for example suggest some more or less radical modifications, and they may stimulate criticism. Thus Thales's theory that the earth floats on water re-appeared in a modified form in Anaximenes, and in more recent times in the form of Wegener's theory of continental drift.'[1] Thus speculative, non-empirical and false theories have more to contribute to the growth of science than true observational theories.

In fact, the critical and corrective approach of the Presocratics towards their own theories contradicts the well-known Baconian infatuation with truth and its glorification of scientific theories as irrefutable, inviolable final truths about nature. The theory proposed by Thales, the teacher, stands surpassed by a superior theory coming from none other than Anaximander, his pupil. It is the tenacity towards solving the problems (by increasingly better theories) which characterises the Presocratic attitude. The following lines by Popper amplify this point in his characteristic lucidity, 'we must not forget that the function of the Baconian myth is to explain why scientific statements are true, by pointing out that observation is the 'true source' of our scientific knowledge. Once we realize that all scientific statements are hypotheses, or guesses, or conjectures, and that the vast majority of these conjectures (including Bacon's own) have turned out to be false, the Baconian myth becomes irrelevant. For it is pointless to argue that the conjectures of science—those which have proved to be false as well as those which are still accepted—all start from observation'.[2]

Thus, the conclusion in a nutshell emerges that not only logic but history too speaks contrary to the Baconian concept of knowledge and scientific knowledge. The Presocratic story, a forgotten chapter of history, evinces that knowledge is all one piece. Their is no distinction between the essence of philosophy and the essence of science. In fact, philosophy is the forerunner of modern science. Knowledge originates in cosmological and cosmogonical questions not in naive questions about sense—objects. The fabric of knowledge is reared with bold speculations, imaginations transcending sense-experience, rather than with confirmations of received sense-data. The inventory of

1. Popper : Conjectures and Refutations p. 141.
2. *Ibid.*, p. 138.

human knowledge increases through critical overthrowing of speculative theories, not through corroborative fortification of them. These historical suggestions about the nature of knowledge pave the way for Popper's major position that falsification not induction is the essence of science as well as of knowledge as a whole. This Popperian position shall be discussed at length in the section on his scientific method.

Indeterminism and Human Freedom.

It has been mentioned even earlier that Popper's self-assessment is that he is an indeterminist, a realist and a rationalist. However, one important variant of criticizability is also there and has been already discussed. It is the same as rationality or rational criticism. Realism has already been covered at length in one of the foregoing sections.

Indeterminism is then, the only variant in Popper's metaphysics that remains to be tackled. However, there is nothing wrong in mentioning at the outset that Popper is not a pure indeterminist, his initial declarations to this effect notwithstanding. Towards the end of chapter 6 of objective knowledge in which he discusses his problem at length, he admits that his position is somewhere between determinism and indeterminism with a clear slant towards the latter.

Popper says that in simple terms indeterminism means all clocks are clouds. He selects this analogy because in our common sense view of things, clocks are taken to be symbols of precision; we even talk of 'clockwork precision whenever we wish to describe a highly regular and predictable phenomenon; clouds on the other hand, are generally associated with irregularity and unpredictability. In our common parlance we say, 'the vagaries of weather'. So this is how we perceive the world. Everything in this world, we tend to understand as having more of clockness, less of cloudiness, or invertly, more of cloudiness than of clockness. Thus as a general principle, we perceive things as partaking in both the qualities, of course in varying proportions, with the underlying assumption that clocks are pure clocks and clouds are pure clouds.

When Popper says that, 'all clocks are clouds' he seems to negate our common sense perception of things mentioned above. With a scholarly air he means to say that even the most precise of clocks have a certain amount of irregularity in their functioning. The only thing is that the irregularity is so minute that it defies

normal observation. Thus, cloudiness is all pervading. Every thing in this world is more or less cloudy. That some irregularity also exists in the otherwise regulated functioning of the universe is now the accepted view among the ordinary as well as the learned. Charles Sanders Peirce, the great American mathematician and physicist and, as Popper believes, one of the greatest philosophers of all time confirmed this with experimental evidence. He said that, 'there was a certain looseness or imperfection in all clocks, and that this allowed an element of chance to enter.'[1] He therefore understood the world as an 'interlocking system of clouds and clocks, so that even the best clock would, in its molecular structure, show some degree of cloudiness.'[2] He 'conjectured that the world was not only ruled by the strict Newtonian laws, but that it was also at the same time ruled by laws of chance, or of randomness, or of disorder : by laws of statistical probability.'[3]

Peirce confirmed his view by pointing out that all physical bodies, even the jewels in a watch were affected by molecular heat motion. These bold conjectures of his were later corroborated in 1927 by Hisenberg's quantum theory—the biggest forte of indeterminism.

Thus, the belief in the essential cloudiness or chance like nature of the universe is the basic presumption of indeterminism.

Why was this presumption such an important discovery for Popper and for his predecessor, Arthur Holly Compton? Precisely because it allowed some scope for freedom to enter into the otherwise rigid framework of the world. This scope or opening was ruthlessly foreclosed by the determinism of Newtonian dynamics, the giant predecessor of all indeterminist theories, for it held absolute sway over the minds of scholars for nearly 250 years.

In simple terms, Newton's theory meant that, 'all clouds are clocks'. Everything in this world, even the most cloudy of clouds functioned with clockwork precision. What Newton meant to say was that the world was a perfectly designed machine, even to the smallest detail, and if we had the minutest possible knowledge of a phenomenon, we could predict (or even retrodict) its behaviour with infallible accuracy. The success with which Newton proved his conjectures was astonishing. For, he not only predicted with superb accuracy the motion of planets, but also the behaviour of

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Thus the theory described the world as a world of absolute mathematical precision. It was perfectly mechanised, self contained system in which everything went on strictly predictable lines, according to well laid down immutable laws. This closed system did not allow of any opening or intervention by any alien force whatsoever. It was this alleged 'closure' of the system which made the scene very suffocating for human freedom. In fact freedom was rendered meaningless in the scheme of things. The question was cogently raised by Compton in the opening passage of his The Freedom of Man :

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> If.....the atoms of our bodies follow physical laws as immutable as the motions of the planets, why try? What difference can it make how great the effort if our actions are already predetermined by mechanical laws.....?[1]

Thus determinism clearly implied that if every action, every movement in the world was predetermined, there was no point for man to make efforts or strive to make a difference in his life or destiny. Man's freedom had no meaning. His thoughts, feelings, actions did not happen to change things decisively. These non-physical stirrings had no autonomy of their own. They were mere illusions or, at best, superfluous by products (epiphenomena) of the physical world. The whole world, in fact, appeared a huge machine in which individuals became mere cogwheels or at best, sub-machines within it.

That men are physically controlled automata, rather computing machines, whose moral emotional world is only illusory, powerless—are the pessimistic, depressing connotations of physical determinism. Popper rightly admits that it is this alleged 'self contained' nature of the whole system and the consequent redundancy of human freedom and feelings in it that duly troubled him and Compton as well. However, Compton tried to escape this highly dehumanising conclusion—the determinist's nightmare as Popper terms it—by developing an intellectual split personality. Fortunately Popper was spared this fate because, by

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his time, the quantum theory had empirically proved the fallacy of scientific determinism. Thus he was in a position to assert unequivocally that determinism is a wrong philosophy. It pre-empts the potential of freedom and creativity in man and the fact of novelty in nature at large.

Popper, and before him Compton, turned to indeterminism because with its axis in chance, it offered a relatively better picture for freedom vis-a-vis determinism. Yet at the cost of repetition, it should be asserted that indeterminism was only 'relatively better' than determinism, not 'good enough' so far as the real issues were concerned. In fact, chance had more of a reactionary and negative virtue. In a mechanically closed, complete, and therefore morally suffocating, Newtonian system only a small opening, a cleavage was admitted by chance. This small opening was the only hope of freedom that indeterminism could offer. Compared to the dismal picture painted by determinism, even this faint hope seemed quite heartening and explained why Popper was led to declaref his allegiance to indeterminism. However, beyond this faint hope it does not promise a meritorious answer to the vital problem raised by Popper and before him, by Compton, namely, of understanding the dynamics of the autonomous rational, moral world created by human beings.

In fact, if Newton's determinism forecloses ex hypothesis the possibility of an autonomous moral will in man or the emergence of novelty in nature, the recognition of chance by Peirce's indeterminism or by Hisenberg's quantum theory offers no more than an anemic relief to them. This theory designs quantum jump models especially to explain the nature and possibility of human freedom. In these models the unpredictability of one quantum jump is considered analoguous to a major human decision. It may be so, yet it cannot be taken as an example of rational human decision. Popper, therefore, admits that at best a quantum jump model may be seen as a model for a snap decision. There is no doubt that human being do take snap decisions. Pilots, drivers or even warring army men have to take snap decisions. yet they aren't very interesting. Moreover, they are not characteristic of rational human behaviour. They cannot explain ordinary moral decisions taken by ordinary men. The truth is that, the quantum jump model does not carry us too for. It only seems to support the thesis of Hume and Schlick that the only alternative to perfect determinism is sheer chance. In fact Schlick took this over from

human knowledge increases through critical overthrowing of speculative theories, not through corroborative fortification of them. These historical suggestions about the nature of knowledge pave the way for Popper's major position that falsification not induction is the essence of science as well as of knowledge as a whole. This Popperian position shall be discussed at length in the section on his scientific method.

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his time, the quantum theory had empirically proved the fallacy of scientific determinism. Thus he was in a position to assert unequivocally that determinism is a wrong philosophy. It pre-empts the potential of freedom and creativity in man and the fact of novelty in nature at large.

Popper, and before him Compton, turned to indeterminism because with its axis in chance, it offered a relatively better picture for freedom vis-a-vis determinism. Yet at the cost of repetition, it should be asserted that indeterminism was only 'relatively better' than determinism, not 'good enough' so far as the real issues were concerned. In fact, chance had more of a reactionary and negative virtue. In a mechanically closed, complete, and therefore morally suffocating, Newtonian system only a small opening, a cleavage was admitted by chance. This small opening was the only hope of freedom that indeterminism could offer. Compared to the dismal picture painted by determinism, even this faint hope seemed quite heartening and explained why Popper was led to declaref his allegiance to indeterminism. However, beyond this faint hope it does not promise a meritorious answer to the vital problem raised by Popper and before him, by Compton, namely, of understanding the dynamics of the autonomous rational, moral world created by human beings.

In fact, if Newton's determinism forecloses ex hypothesis the possibility of an autonomous moral will in man or the emergence of novelty in nature, the recognition of chance by Peirce's indeterminism or by Hisenberg's quantum theory offers no more than an anemic relief to them. This theory designs quantum jump models especially to explain the nature and possibility of human freedom. In these models the unpredictability of one quantum jump is considered analoguous to a major human decision. It may be so, yet it cannot be taken as an example of rational human decision. Popper, therefore, admits that at best a quantum jump model may be seen as a model for a snap decision. There is no doubt that human being do take snap decisions. Pilots, drivers or even warring army men have to take snap decisions. yet they aren't very interesting. Moreover, they are not characteristic of rational human behaviour. They cannot explain ordinary moral decisions taken by ordinary men. The truth is that, the quantum jump model does not carry us too for. It only seems to support the thesis of Hume and Schlick that the only alternative to perfect determinism is sheer chance. In fact Schlick took this over from

Hume like many of his deterministic assumptions. Hume asserted that 'the removal' of what he called 'physical necessity' must always result in the same thing with chance. As objects must either be conjoined or not,.....'tis impossible to admit of any medium betwixt chance and an absolute necessity.'[1] Hume, by conceiving of chance as the other extreme of necessity, in a way, anticipated indeterminism. In the same section on page 407, he identifies liberty with chance :'.....liberty,.....is the very same thing with chance.' Since Hume, and accordingly Schlick believe in a physically complete world, any concept of moral freedom naturally falls within that causal periphery. Anything outside is mere ignorance. If liberty is another name for chance, as Hume is quoted to have said, this liberty *ipso facto* becomes synonymous with ignorance or moral irresponsibility. As a determinist like Schlick has expressed it, 'freedom of action, responsibility, and mental sanity, cannot reach beyond the realm of causality : they stop where chance begins.....a higher degree of randomness.....[simply means] a higher degree of irresponsibility.[2]

The above argument gives rise to one more analysis : be it man's ordinary rational conduct or his creativity in art, science or literature, an explanation by sheer chance seems highly implausible. Man's moral and creative endeavour has an element of unpredictability or novelty that explains much of its charm and beauty. This aspect can be well explained by chance. Yet morality and creativity have one more aspect of rationality that is teleological and does not bear even minimum semblance to randomness, another major element in the constitution of chance. Thus the thesis arises that the moral-creative nature of man partakes in the unexpectedness of chance without partaking in its randomness. Unfortunately determinists don't perceive chance that way. They outright stigmatise it as moral irresponsibility, as says the above quotation from Schlick.

Another significant element, as mentioned earlier is creativity. And it is not an endowment of human beings alone. As Popper insists, nature at large, is also imbued with it. 'Even science.....suggests to us.....a picture of a universe that is inventive or even creative; of a universe in which new things emerge on new levels.'

1. D. Hume, op. cit, Book 1, part III, section XIV; p. 171. (as quoted by Popper in Objective Knowledge; p. 227.)
2. Schlick as quoted by Popper Objective Knowledge, p. 226-227.

'Michelangelo, Mozart, Darwin.....Natural selection has destroyed the proof for the miraculous specific intervention of the Creator. But it has left us with the marvel of the creativeness of the universe, of life, and of the human mind.'[1]

Popper praises Darwin's theory because it recognizes the immanent creativity and rationality of nature. For, the theory depicts nature as weilding a rational control over the apparently random course of the evolution process.

Yet chance again cannot explain the phenomenon of creativity either in nature or in man. Popper illustrates this point in a simple but convincing passage :

> '.....to say that the black marks made on white paper which I produced in preparation for this lecture were just the result of chance is hardly more satisfactory than to say that they were physically determined. In fact, it is even less satisfactory. For some people may perhaps be quite ready to believe that the text of my lecture can be, in principle completely explained by my physical heredity including my upbringing, the books I have been reading, and the talks I have listened to; but hardly anybody will believe that what I am reading to you is the result of nothing but chance—just a random sample of English words, or perhaps of letters, put together without any purpose, deliberation, plan or intention.'[2]

Similarly, all the symphonies and concertos written by Beethovan or Mozart cannot be attributed only to physical factors. (Had it been so, they could be reproduced by a deaf physicist, who had never heard music, by merely studying the precise physical states of the musicians' bodies and predicting where they would put down black marks on their lined papers.) But, at the same time, they cannot be attributed to chance either. The passage quoted above shows this amply clear.

Be it ordinary rational human conduct, an argument or a piece of music, the explanation by determinism or by sheer chance is equally unsatisfactory. Thus we come back to Popper's earlier position that, 'like Compton, I am a physical indeterminist : physical indeterminism, I believe, is a necessary prerequisite for

1. Popper : 'Natural Selection and the Emergence of Mind' published in Dialectica 32, 1978. As quoted in David Miller; A Pocket Popper, Natural Selection And Its Scientific Status, pp. 240-241.
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any solution of our problem. We have to be indeterminists; yet..... indeterminism is not enough.

With this statement, indeterminism is not enough, I have arrived,.....at the very heart of my problem.

The problem may be explained as follows. If determinism is true, then the whole world is a perfectly running flawless clock, including all clouds, all organisms, all animals, and all men. If, on the other hand, Peirce's or Hisenberg's or some other form of indeterminism is true, then sheer chance plays a major role in our physical world. But is chance really, more satisfactory than determinism.'[1]

Thus Popper's skepticism towards both the extreme explanations is very evident and, of course well convincing. The phenomenon of freedom and human creativity, he suggests, can be understood by adopting a midway position—somewhere in between the two philosophies—with a slight hunch towards indeterminism with which it has more in common. Popper says, "What we need for understanding rational human behaviour—and indeed, animal behaviour—is something intermediate in character between perfect chance and perfect determinism—something intermediate between perfect clouds and perfect clocks.'[2]

Popper needs this intermediate position understanding rational human behaviour; This means the dynamics of the realm of aims, purposes, deliberations, arguments, plans, decisions, theories, laws, intentions and values. They are expressions of human creativity of man's freedom to create something new, something non-physical out of the pre-existing physical world. Moreover, Popper needs this intermediate position to understand how this novel, non-physical world of his creation attains an autonomous status of its own, and then, by its sheer power influences and controls him and brings about physical changes in the physical world. This interaction does take place inspite of what determinists like Hume, Laplace and Schlick might say.

'For obviously what we want to understand how such non-physical things as purposes, plans, decisions, theories, intentions, and values, can play a past in bringing about physical changes in the physical world. That they do this seems to be obvious, pace Hume and Laplace and Schlick. It is clearly untrue that all those tremendous physical changes brought about hourly

1. Popper : Objective Knowledge, p. 226.
2. Popper : Objective Knowledge, p. 228.

by our pens or pencils, or bulldozers, can be explained in purely physical terms, either by a deterministic physical theory, or (by a stochastic theory) as due to chance.'[1]

'How do non-physical products of human mind bring about physical changes in the physical world', this inquiry by Popper reminds one of a similar inquiry raised by Kant. It was perhaps Kant who was the first to ask the question that if man cannot know nature, and that he can know only that which he himself has created, how is it that nature obeys laws made by man?

In the analogy of clouds and clocks, mentioned by Popper at the outset, perfect clouds stand for total ignorance and perfect clocks for total knowledge. The philosophy of determinism can be identified with perfect clocks because of its claims to omniscience, whereas perfect chance can be sided with perfect clouds and shall be deemed to symbolise ignorance. Both determinism and indeterminism seem to suffer such extreme ontlogical presumptions. In epistemological terms, the whole world then seems to become either amenable to total knowledge or is relegated to total ignorance. This precisely is the position taken by Hume and Schlick when they say that in the determinist world, chance is nothing but a symbol of our ignorance. Hume says, 'Even when these contrary experiments are entirely equal, we remove not the notion of causes and necessity, but.....conclude, that the [apparent] chance .....lies only in.....our imperfect knowledge, not in the things themselves.'[2]

From what has gone above, it is clear that Popper refuses to accept such ontological and epistemological extremes. However he is reticent upon ontological issues and does not go beyond admitting his faith in the (ontological) existence of truth. Epistemology is his sole concern. It is one of partial knowledge and partial ignorance. It is precisely that intermediate position that Popper needs to understand the phenomenon of freedom and human creativity. Even otherwise the world cannot be comprehended in black and white. Either it can be known fully or not known at all—is a mistaken assumption. Popper promotes the idea that we may know a thing to some extent but we may not know it to the fullest possible extent. This is common sense and science also seems to support it. We have already seen how

1. Popper : Objective Knowledge, page. 229.
2. Hume op. cit., Book II, Part III, Section 1; p. 403 f. as quoted by Popper in his Objective Knowledge p. 221.

Compton proved that every thing in the world, even very precise clocks are prone to irregularity. On the contrary, weather forecasting proves that clouds are not absolutely vague, their behaviour can be predicted successfully although for very short periods.

> "For we know that even highly reliable clocks are not really perfect, and Schlick (if not Hume) must have known that this is largely due to factors such as friction—that is to say, to statistical or chance effects. And we also know that our clouds are not perfectly chance like, since we can often predict the weather quite successfully, at least for short periods.'[1]

Thus, in the Popperian hierarchy of values, human decisions, aims and purposes, rational intellectual products and creative endeavours, in short the world freedom, is on the highest echelon. So far as recognizing and analysing this world of freedom is concerned, determinism is a dismal philosophy. Indeterminism is relatively better. It recognizes freedom in a minimal way, yet not good enough because does not build a strong argument in its favour. Popper says that freedom can be understood by a viewpoint positioned in between the two philosophies, being nearer to indeterminism. Perhaps, because of this proximity and also for want of a proper nomenclature for his position, he prefers to remain an indeterminist. But then absence of the right name does not seem to be a limitation, rather it is a disinclination on the part of the philosopher because he is an anti-essentialist. Thus he remains to be called an indeterminist, yet tries sincerely to seek answers to his questions that transcend the limits of indeterminism.

To conclude, it may be said that Popper is immensely enamoured by the existence of the autonomous non-physical world of ideas, values, aims, arguments, laws, theories and machines. What Popper finds amazing about them is that men create them and yet in turn, get controlled by them. They not only get controlled themselves but bring physical nature under their control too. To some extent, the case is one of superiority of the non-physical over the physical. This is why Popper calls himself an indeterminist. Nevertheless, I shall label him : a compromised indeterminist. This non-physical, wonder-world is 'world 3' as Popper names it. However, this world is partially rational, partially

1. Popper : Objective Knowledge, p. 228-229.

irrational and therefore, cannot be explained fully by any of the two major philosophies—rationalism and irrationalism, for they depict the world as totally rational or totally irrational. Their epistemological position vis-a-vis the world is, then, one of pure knowledge (determinism) or pure ignorance (indeterminism). On the contrary, world 3 can be comprehended only by a view point of partial knowledge and partial ignorance, and should be juxtaposed between the two philosophies. (World 3 is elaborated in Popper's theory of knowledge).

Natural Selection and its Scientific Status.

Popper is an indeterminist because he cherishes freedom and creativity above everything. These twin virtues, or may we say, only one, since the former presumes the latter, are neither grossly mechanical, though exude rationality, nor chaotic, though bear the charm and the mystique of unpredictability. The truth is that man's creative freedom is not absolute; it expresses itself in a situation precisely by correcting it and then building upon that correction. The process is logical but creative. It finds a good example in Darwin's theory, maintains Popper. It corroborates the philosopher's thesis that not only man but nature too is endowed with creativity.

Popper agrees with Darwin's principle that the process of the evolution of species in the universe has worked on the principle of natural selection. Popper admits that the theory of natural selection has a poor status as a scientific theory, but is, nevertheless, highly beneficial as a metaphysical programme. This is so because it underlines the element of choice, *i.e.*, freedom of choice in nature and thus in human life.

Thus Darwin's theory of natural selection is important for Popper because it substantiates his basic argument of free but rational choice in ethics as well as in epistemology. Darwin's theory emphasizes random mutation in the genetic structure of the molecule but also explains the rationale behind it, *i.e.*, environmental pressure.

Popper believes in the essential rational freedom of man. Man's freedom is not chaotic, not inexplicable. There is always a rationale behind his choices. What Darwin's theory reaffirms is that Popper's assumption is as true about the biological world as it is about man's moral world. Freedom, as Popper envisages, is a matter of multiple choices available at any given point of time, and

the actor choosing from amongst them according to the pressure generated upon him either by the environment or by reason. Now the significance of Darwin's theory of natural selection is admitted by Popper because he sees in it a confirmation on the biological plane of his own thesis.

Darwins theory goes on to say that all living species are constantly adapting themselves to their environment. However, this process of adaptation is effected by an unconscious selection on their part, of the most suitable mutation from amongst the numerous mutations accumulated in their gene pool over a long period of genetic evolution. It further purports to say that those who adapt to their environmental demands, survive, those who don't, perish. What Popper wants to underline in Darwin's theory is that the phenomenon of biological survival is a matter of trial and error. The environment is constantly weilding its pressure on the organism. The latter tries to meet it by randomly throwing up its various genetic capabilities from among the vast store of genetic mutations available to it in its gene structure. The environment picks up the most suited mutation or capability which thereby causes a permanent change in the organic structure of the creature. This is an on-going process. For the organism it is a process of self-correction in which it is constantly involved. The survival of an organism is its victory over its environment. However, this victory is ensured only in proportion to his capacity to make the right choice, which means, to elicit the right genetic answer. What Popper likes in this theory immensely is its merit of depicting the universe as a creative yet reasoned structure. The evolution of species in it is neither a matter of pure coincidence (indeterminism) nor that of the perfect design of a Creator (Paley's famous argument from design). It is rather a matter of randomly present options and a rational choice made therefrom. It is this element of reason which is conveyed by the word 'selection' in the Darwinian theory.

A vast repertoire of randomly fluctuating genetic mutations. Environmental invariants wield incessant pressure on that species, thus picking up the most apt mutation. This mutation gets more and more pronounced with successive generations.

The gene pool may be a randomly behaving one; perhaps can be explained by quantum indeterminacy, but the act of selection is not a randomly performed one. It is an act of free, logical choice. It speaks for rationality in nature.

EPISTEMOLOGY

"The phenomenon of human knowledge is no doubt the greatest miracle in our universe.

.....Since Descartes, Hobbes, Locke and their school, which includes not only David Hume but also Thomas Reid, the theory of knowledge has been largely subjectivist : knowledge has been regarded as a specially secure kind of human belief, and scientific knowledge as a specially secure kind of human knowledge."

> ".....a tradition, that can be traced back to Aristotle—the tradition of this common sense theory of knowledge. I am a great admirer of common sense which, I assert, is essentially self-critical. But while I am prepared to uphold to the last the essential truth of common sense realism, I regard the common sense theory of knowledge as a subjectivist blunder. This blunder has dominated Western philosophy. I have made an attempt to eradicate it, and to replace it by an objective theory of essentially conjectural knowledge." —Karl R. Popper : Objective Knowledge An Evolutionary Approach 1973, Oxford.

Some Underlying Assumptions of Popper's Epistemology or Philosophy of Knowledge.

Experience teaches man that the world around him is neither friendly nor alien towards him; that his ability to survive in it is decided by his ability to adapt himself to it. This ability of adaptation is proportionate to his knowledge of the world. Successful survival, therefore, depends upon proper knowledge. Since survival is an essentially human problem, the next question *ipso facto* emerges : what should be the most commonsensical or, may we say, the most humanly possible way of knowing the world? Apart from its survival-value, the eagerness to know is one of the most basic insticts of man qua man, the mark of his supremacy over other creatures.

Some important suggestions emerge from the above passage : the issue of knowledge in Popper is a very broad based one. Since

it is essential for human survival it is every man's concern. No elitist trappings or exclusivity is associated with the quest of knowledge in Popper—a democratic, open-ended endeavour as we may call it. But, at the same time, it is the practical purpose of knowledge that is the focus. Knowing nature not for the sake of knowing it, but for the sake of conquering it, so as to improve man's survival in it, is the guiding force behind man's quest for knowledge. Thus the commonsensical, the equilitarian and the pragmatic (utilitarian) attitude is the characteristically Popperian attitude towards knowledge; it is also the distinctively modern view point towards knowledge, specially scientific knowledge.

Popper's Ideas on Truth.

As Bryan Magee puts it, the concept of falsifiability, is the key concept that explains Popper's epistemology. Nevertheless, I personally feel that not only in Popper but in any philosopher, the concept of truth is the core of his epistemological ideas. The purpose, avowed or assumed, of any epistemology is the discovery of truth. This may *prima facie* appear to be a very simplistic comment but ceases to be so when examined closely. What precisely does it mean that the purpose of knowledge is truth? Truth is indeed, the strongest desire of man and the greatest driving force behind the empire of knowledge he creates in all its variety. The pursuit of truth has two meanings in epistemology : firstly, that there exists some final truths about things. Secondly, that man can know them. In a different form this idea can be stated thus : any epistemology, worth its salt, has faith in the objective existence of truth and in man's capacity to know that truth. The first faith is ontological, the second may be termed methodological. Thus any theory of knowledge begins with an ontological and a methodological faith in truth.

Modern philosophy and science of the West have been imbued with the ideal of truth in this very sense. I mean to say that Cartesian rationalism on the one hand, and Bacon's inductive science on the other, are thoroughgoing celebrations of this faith. Plato's philosophy although much more predated and different has the same ideas about objectivity and knowability of truth.

Popper's originality lies at the outset, in this very notion of truth. He accepts the ontological existence of truth but rejects its accompanying methodology. He admits that there exists a truth about things and that knowledge aims at it, but rejects the

traditional claim that man can ever attain it. Following Xanophanes, he believes that truth does not have a distinct aura about itself, thus man cannot recognize truth qua truth even if it is present before his eyes. Thus for all practical purposes, truth as truth is unknowable is the basic presumption of Popper's. A very gloomy picture to start with, no doubt, for it only means, over and above everything, that man is condemned to strive into his cast for a purpose never to be achieved by any mortal whosoever. This I think is the epistemological predicament of man that Popper wants to assert from the very beginning. It is reminiscent of the political philosophy of the church fathers of the Middle Agro, namely, Acquinas and Augustine. Their political discussion is unparalleled in the whole history of Western philosophy for one particular reason : it deliberates upon the secular limits of politics from an overwhelming spiritual standpoint.

This spiritual context has been the originality of scholasticism, and no doubt, its strength. Some parallels can be drawn here between scholasticism and Popper's primary concept of truth. Both start on a sober note of despondency, in different contexts, no doubt. The fathers say that man cannot come to the Truth through political life. Nevertheless, this lack of hope is not final. There is a ray of hope if man abandons political life and embraces a spiritual life. In Popper the realization of a void is more final because it is logic and secularity untranscended.

But then this negative interpretation has not been suggested by Popper anywhere. Infact, his concept of truth is ambivalent. It has at the same time a positive and a negative undertone. The passage above is my own interpretation of the pessimistic reverberation's in Popper's concept of truth. So far as Popper's own system is concerned, he develops the positive aspect of truth to mean that the quest for truth is unended, man can never rest satisfied. The pessimistic aspect, *i.e.* the idea of the logical unattainability of truth has been interpreted by Popper as a potent check upon intellectual and moral authoritarianism.

The above passages necessitate an elaboration of the optimistic and the pessimistic aspects of Popper's thought. It will be done later.

On a closer examination, however it appeared to me that not truth but the element of problem provides a better perspective to an analysis of Popper's theory of knowledge. It seems more convincing as a starting point. Mere truth-seeking is too lofty, too

intellectual or may we say, too unrealistic a purpose which cannot explain the practical or moral relevance of knowledge in man's life. Popper is cogent on the point that the pursuit of knowledge starts with problem solving. This is a more realistic picture of the beginnings of knowledge and is a good proof of Popper's realistic metaphysics. Problem solving, as an enterprise is common to living beings. It is the basic requirement of the organic life seeking survival in an alien atmosphere.

If a hypothetical question be raised as to what should be the aim of knowledge : truth seeking or problem solving? Popper's answer seems to be the latter. It is the need of problem-solving that gives the activity of truth-seeking its purpose and direction. Man tries to know the truth because he wants to solve his problems—problems that agitate or interest him. He gets direction in the sense that he does not need to know all types of truths, but only those that solve the difficult or fertile problems confronting him. It is a sort of editing or streamlining of the various types of truths scattered around man. Popper clarifies this by saying that 'we do not merely want truth—we want more truth, and new truth.....what we look for are answers to our problem.'[1]

A little nursery rhyme by the German humorist and poet Busch states this fact very clearly and simply. Popper quotes his own translation of that rhyme.

'Twice two equals four;' tis true,
But too empty and too trite.
What I look for is a clue
To some matter not so light.[2]

Same is the case with science. Popper has made it amply clear at several places that the nature of science is an abstraction of the nature of knowledge, and that whatever he says about science is also true for knowledge at large and vice versa. His words are, 'My interest is not merely in the theory of scientific knowledge, but rather in the theory of knowledge in general. Yet the study of the growth of scientific knowledge is, I believe, the most fruitful way of studying the growth of knowledge in general. For the growth of scientific knowledge may be said to be the growth of ordinary human knowledge writ large.'[3]

1. Popper : Conjectures and Refutations, p. 229.
2. Popper : Conjectures and Refutations, p. 230.
3. Popper : Logic of Scientific Discovery, Preface.

The task of science is the search for true theories. Not only true but interestingly true; theories which are true but at the same time hard to imagine. And especially in the natural sciences we look for truth which has a high degree of explanatory power, which in turn implies that it is logically improbable.'[1]

Thus Popper is clear enough by what he says above that it is only when it solves a deeper problem that any truth or more precisely, a conjecture about the truth becomes relevant to science. This is so in mathematics and also in the natural sciences. The depth of the answer is measured by its logical improbability or explanatory power as compared to the previous answer. In fact, science can be explained in many ways. But the most realistic and existential interpretation would be one that visualises science as a procession from deep problems to even deeper ones. The purpose of science is to discover an explanation of the problem at hand. Scientific theories are, therefore, explanatory theories. But for reasons well elaborated by Popper, science does not give authoritative explanatory theories. It can only improve its explanatory power by degree, continuously replacing theories by even better theories.

On many occasions Popper has stressed the identical nature of knowledge in general and science in particular. But he admits one minor difference. He says that theories in essence, are expectations and in this form they may historically precede problems, for some expectations are in-born. (It is in this sense that Popper talks of in-born knowledge). But science starts only with problems. In fact, problems confront us when we are disappointed in our expectations, or when our theories land us into difficulties. One thing is clear that its only a problem that makes us conscious of possessing a theory. Moreover, in Popper's words, "it is only the problem which challenges us to learn; to advance our knowledge; to experiment; and to observe.'[2]

Now if we keep in mind the inductive theory of scientific knowledge, we will be able to grasp the right perspective for understanding Popper's ideas on the various aspects of the method of science. Since the inductionists believe that science starts with observation Popper refutes them when he says that it starts with problems. Although observation does give rise to a

1. Popper : Conjectures and Refutations, p. 229.
2. Popper : Conjectures and Refutations, p. 222.

problem, specially when an unexpected observation clashes with our expectations or theories. In such a case, the conscious task before the scientist is to construct a theory which explains the unexpected and unexplained observation. Yet the causal sequence between a theory and a problems not a very basic question. Any worthwhile theory solves a problem on the one hand, but raises new ones, namely, how to conduct absolutely new, unthought of observational tests. The lasting contribution that a theory makes to the growth of scientific knowledge is the set of new problems which it raises. All this finally supports Popper's thesis that knowledge in general and science in particular starts and ends with problems, increasingly deeper problems. It is, therefore in the endless generation of theories and of problems that knowledge finds its existence and continuance.

Some other Theories of Truth : Popper's Criticism of them.

Popper describes himself as a realist. His, as he terms it, is a realist theory of science and knowledge. The two theories which he rejects are essentialism and instrumentalism. He acclaims Tarski's theory of truth because it helps him expose the fallacy of induction. This shall be discussed later. Basically these theories are the philosophical postulates of pure science. They constitute, what is termed as the philosophy of science. Do working scientists actually governed by them Popper warns that they are relevant only for pure theoretical research and not for what he terms as the 'B' team of scientist, who are one may say, the corroborationists, since they are concerned only when applying the findings of pure science.

I think that Popper is right when he rejects both essentialism and instrumentalism. These are two philosophical polarities. One purports to say there is something like one absolute truth. Science, in fact knowledge at large, seeks to discover it. True theories successful theories are the ones which have actually attained it. They exemplify truth. And the proof of their veracity is their accordance with facts. Nature actually obeys them when they are applied to it. The instrumentalist view presumes that there is no such standard of truth which is absolute and objective; scientific theories are mere workable hypothesis, nature is an apparatus and theories have only to be modified to in order to make them fit into the apparatus. How then will the variety of theories be explained?

The instrumentalist say every new theory is an improvement upon the previous ones. Some deficiency somewhere in the previous one which makes it inapplicable to some set of facts in the apparatus. Another theory replaces it in the sense that it explains those very set of facts. Thus every new theory is an improvement upon the previous theory. Its novelty lies in being better, in explaining the apparatus where the previous one is silent. Thus no theory is ever true. In fact no objective truth, no reality what we call progress in science is in fact replacement of previous theories by better ones.

This is a degraded view of science. Science looses much of its genuineness, its appeal becomes a futile exercise. Popper should be given the credit of salvaging the dignity of science taken away by instrumentalism. He admits the existence of some independent truth and with equal candidness admits also that the purpose of science is to come to that truth. The world of science deals with a genuine world of reality, not a pseudo world of ideas or theories about that reality. The proof lies in the ability of the theories to correspond with the nature. Theories are genuine efforts to know reality and they actually arrive at it, although in their own characteristic way fashion is Popper's unequivocal stand. And when it comes to explaining the existence of a multitude of theories, Popper does not view them as succession of increasingly better theories. Popper says that every theory is significant in its own way precisely because it explains one aspect of reality. No theory refutes the previous one, it only demarcates the precise area in which the latter is applicable. While in its own capacity it answers some questions hitherto unanswered. Yes, in one sense Popper does come closer to instrumentalism and that is in his assumption that every new theory is *ipso facto'* a better theory because while it explains some phenomenon explained by a previous theory, it also explains some new phenomenon hitherto unexplained by the earlier theory. In short, a new theory is new in the sense that it is better, it tells more.

This is Popper's realist view of science, as contrary to the essentialist and the instrumentalist views. But the most curious part of his realism lies in his concept of refutation or his criterion of progress in science, as one may say. Figuratively it may be said that for Popper, progression lies in regression, a theory is better in the sense that it tells you less than the older theories. About what does the theory tell? Here Popper is one with the essentialist. Yes, it tells you some truth about the reality outside. It is not pure

hypothesis as instrumentalists tend to think. Theories, no doubt, are hypotheses, mere conjectures, having no pretensions of telling the ultimate truth. No one knows truth. It is shrouded in mystery, nevertheless it denotes an obscurantist element in Popper. Certainly a dramatic one, where even the lowly conjecture confronts the mighty, the inscrutable and the awesome truth. This point is where any theory gets falsified by some set of empirical facts. Scientific theories are realistic, they give you a glimpse of truth not by being in accord with nature but by being at variance with nature. In other words, it doesn't tell you the positive truth, rather tells you negatively what is not the truth. When nature disobeys theory, the latter stands refuted and that refuting fact defines the limits of that theory. What Popper wants to bring home is that no theory can ever be verified. There is something like truth, but science can never know it affirmatively. Theories can only come closer to it by purging themselves of the untruth in them. And empirical falsification is the way to it. Thus, not discovery of truth but approximation to truth is the real purpose of science. The approximation, curiously enough is an inverted process, it consists in negating theories rather than in verifying them. And this, indeed is Popper's final answer to the inductionists.

Knowledge as a critical tradition.

These were no doubt important but peripheral discoveries. The main support that Popper has drawn from the Presocratic story is in favour of his concept of the nature of knowledge. The basic aspects of that concept are as follows : human knowledge is not discovery of a final truth; it is only an attempt to learn it. Being an attempt, it is liable to error which can only mean that all knowledge is a conjecture of truth; a guess or a hypothesis in the pursuit of truth. The question emerges whether all human knowledge is condemned to ignorance? can it never see the light of truth? What will happen to man's insatiable urge for truth? How can the inherent limitation of knowledge and the goal of knowledge be reconciled? Popper is backed by the rationality of the Presocratics in his thesis that it is only in criticising our conjectures that the hope of expanding our knowledge lies. Criticism is an indispensable part of human knowledge. The Popperian logic means that for an enterprise which naturally errs, conscious error elimination is its only redemption if it has to fulfil its task of knowing the truth about the world. This aspect of rational criticism has important consequences for the nature of

knowledge and for the theory of that knowledge. It earns the name of critical rationalism for Popper's theory of knowledge which shall be dealt with a little later.

To begin with, truth-seeking no more remains a lonely activity of a single person. It becomes a social affair (Popper develops a whole set of ideas relevant to this aspect which go in to constitute something like a sociology of knowledge). But more important than that, criticism joins all the truth-seeking attempts, namely theories as if in one invisible rational chain. A number of solutions proposed to a single problem do not remain in a disjointed, chaotic condition. They are rather well-arranged by a logical interconnection. Every answer is put forth by its originator and accepted by others only if it corrects the flaw of some other answer. Thus changes in doctrine or in philosophies are termed as innovations and are welcomed as signs of progress. In this critical perspective, knowledge is viewed by Popper as a process of bold innovations (no doubt conjectural) and severe critical examination of the innovations. Such a concept of knowledge presupposes a tradition of rational discussion, a culture of frank criticism and tolerance towards dissent . Only with such a tradition in the background can a history of ideas take roots, for it is only then that every viable answer with the name of the originator along with the older answers are handed down from one generation to another generation. It is only due to the element of criticism that knowledge assumes that nature of tradition.

Theory of Knowledge as Critical Rationalism.

Now we come to the precise role of rational criticism in the attempts of man to come nearer the truth in the course of solving his problems. It happens so that the hypothetical solution that an answer offers to a problem is its positive aspect and the critical element that it contains is its negative aspect. The function of this negative aspect is to single out consciously and deliberately, the defects of a previous answer and in this way purgate it. In science, observation and experiments perform the critical function alongside other non-observational arguments. Popper is very clear that the only purpose of observation and experiment is to criticise theories. He tries to refute the inductive concept that observation creates theories and experiment validates them. Popper says that one theory is superior to the other in two respects : either it explains more or is better testable. This testing or critical

examination of theories is the only element of rationality in our attempt to know the world, says Popper. Conjectures and refutations is the true description of the nature of knowledge in general and science in particular.

These are the salient features of Popper's theory of conjectural knowledge. As has been mentioned earlier Popper finds in the example of the Presocratics considerable historical verification for his theory. The brilliant cosmologies of the Presocratic philosophers, he maintains, are not only original answers to some common cosmic problems; taken together, they also display a strange logical interconnection. It seems as though every solution is a modification upon some other solution given either by a previous generation or by some contemporary philosopher. The mystery of the stability of earth and the phenomenon of change were some of the cosmological problems which intrigued the Presocratic mind. Some of the answers are commonsensical and seem to have originated probably from observation, is Popper's hypothesis. But most of them are highly abstract and speculative. Popper's hypothesis again is that they must have been products of pure reasoning or precisely, of critical examination of previous theories. The solution's they contained were a sort of logical correction consciously done in a preceding theory. Most of them are not only free from the logical error of the previous theory, are bold and original answers yet showing some other logical weakness expecting to be critically examined and corrected by a subsequent theory. It is precisely in this sense that Presocratic cosmologies have a logical continuity, a mutual rational dependence that underlies their apparent dissimilarities. One of the characteristics of conjectural knowledge is its traditional structure. The Presocratic knowledge says Popper, shows for the first time the ingredients that go in to impart a traditional quality to knowledge.

That this sustained critical relationship among theories was possible, according to Popper's conjecture, only because the Presocratics encouraged and welcomed criticism not only as a matter of personal ethics but as a matter of tradition. What Popper wants to stress is that freedom and tolerance towards dissent were supreme moral values in the intellectual culture of the early Greek times. Popper also wants to emphasise that it is the same spirit that has created modern science and also the Western civilization at large.

An unending debate between Popper's deductive theory of knowledge and Bacon's inductive version of it is very basic to Popper's ideas on scientific method. With his essay, Back to the Presocratics, Popper opens this debate. He says rightly that the traditional empiricist epistemology and the traditional historiography are under the total impact of the Baconian image of science and the theory of scientific knowledge. From what Popper initially states here and there, the Baconian epistemology seems to have the following presumptions. Popper refutes them all not so much by logic but by historical evidence supplied by the Presocratic story. Induction means :

—Science starts with simple observational questions. The early Greek philosophies, which anticipated modern scientific theories, began with deep cosmological questions.

Science collects observational facts and then cautiously proceeds towards theorising. The Presocratic cosmologies, on the contrary, are largely results of brilliant imagination.

Scientific theories are true because based upon observations which are true and reliable sources of knowledge. Thus the question of the truth of theories and that of the origin of theories are identical. The history of science shows that many of the supposedly true theories have subsequently been refuted, *e.g.* Newton's physical theories.

Science is different from philosophy because the former is observational or inductive and the latter is speculative or deductive. The Presocratic cosmologies are largely speculative and contain the seeds of many modern scientific theories. Popper even shows this by examples. Thales, the founder of the presocratic critical tradition suggested the modern theory of continental drift. Anaximander's philosophy made possible the theories of Copernicus and even anticipated to some extent, Newton's theory of immaterial and invisible gravitational forces. Thus the common origin of scientific and philosophical endeavours is well established by the Presocratic evidence.

To sum up, it can be stated that Popper's theory of knowledge starts with the purpose of solving cosmological problems. In solving them, its aim is to search for the true answer, ironically, this truth is logically unattainable for knowledge, for truth qua truth can never be known; It can only be imagined. Thus knowledge is conjectural in nature and can only be brought nearer the truth by systematic criticism and error-elimination through its

conjectures. This critical quality about knowledge gives it the character of a rational tradition. This Popperian concept of knowledge is well supported by the actual facts about the Presocratic philosophers. These facts have greater relevance for Popper owing to the reason that they clearly, refute induction on purely historical grounds. Led by which Popper declares induction to be a myth and almost irrelevant for a proper theory of scientific method.

In the next sections such topics will be dealt with in greater detail as the empirical and the rationalist traditions of epistemology, Popper's attack on induction, and lastly, his rationalism or his theory of rational knowledge.

Knowledge : Subjective vs. Objective.

An important aspect of the nature of knowledge in Popper, apart from its critical character, is its objectivity and autonomy. To explain this and the true position of knowledge vis-a-vis other subjects, Popper develops an original theory of three worlds. They are respectively : —

World 1 : the world of physical objects.

World 2 : subjective knowledge. It is the world of states of consciousness. The knower is important here which means that, from his certain inborn expectations to their acquired modification, *e.g.* his beliefs or assertions—everything is included in this category. These aspects Popper terms as the psychology or the sociology of knowledge.

World 3 : this includes objective knowledge in the Popperian sense. It is knowledge independent of any knower. Thought—its theoretical structure, its problems and the critical arguments therein are significant on their own merit. Its examples are : science, literature, works of art, even language, the symbols of which are journals, books and libraries. But the best example according to Popper, no doubt, is scientific knowledge.

Popper says that the distinction of subjective and objective knowledge (world 1 and world 3) is a very important one. World 3 is much more significant than world 1. In fact, any proper epistemology should concentrate on world 3 *i.e.*, problems connected with the structure of scientific theories or arguments. Unfortunately, the traditional epistemologies, namely rationalism and empiricism took world 2 as their subject matter, which is

virtually irrelevant within the Popperian understanding of knowledge. Popper calls them 'belief philosophies'.

Popper stresses the point that although a natural human product, world 3 is largely autonomous. There is a constant interaction going on between world 2 and world 3. The interaction, develops, on the one hand, word 3 and also influences and changes significantly world 2. Popper's arguments for the autonomy of world 3 are as follows :—

(a) If all machines and tools are destroyed but libraries and our capacity to learn from them survives, after some time, we can make mechanical progress once more. But if libraries and our capacity is also destroyed, our development will take at least many millenia.

(b) World 3 is intelligible without world 2, it has meaning and significance independent of world 2 but is not the case vice-versa. An objective epistemology based upon world 3 throws immense light upon world 2, specially upon the theories and methods of scientists and their subjective thought processes.

(c) The possibility of potential books and theories also establishes well the idea of autonomy. Generally world 3 consists of actual books, theories, problems and arguments which have been produced by human beings. Yet, this fact does not preclude the existence of many potential theories, problems and arguments which have yet to be produced and understood by men. They are, Popper says books-in-themselves, problem situations—in- themselves and arguments-in-themselves. They are autonomous in the sense of Plato's forms (although they are much different from the latter.) None-the-less, these objective potentialities represent the autonomous nature of knowledge in the most apt manner.

Observer—Centric Epistemology : Popper's Indebtedness to Socrates and Kant

Kant's Critique of Pure Reason is the peg on which Popper hangs his theory of knowledge, and therefore, his philosophy of science. Kant's critical reason, in turn, derives its philosophical basis from the tradition of Enlightenment. Popper deems Kant to be the last defender of this tradition.[1]

1. Popper, Conjectures and Refutations, p. 176.

Enlightenment for Kant, meant the emancipation of man through knowledge. For him it essentially glorified the courage in man to use his own intelligence in matters intellectual and moral. Here is his own description of the idea of Enlightenment :

Enlightenment is the emancipation of man from a state of self- imposed tutelage.....of incapacity to use his own intelligence without external guidance. Such a state of tutelage I call 'self-imposed' if it is due, not to lack of intelligence, but to lack of courage or determination to use one's own intelligence without the help of a leader.

Sapere aude! Dare to use your own intelligence! This is the battle-cry of the Enlightenment.[1]

Kant emphasised here the autonomy of man, the supremacy and full competence of his rationality in giving him knowledge of the world. True to the idea of Enlightenment, Kant, in fact, stood for the 'human' nature of knowledge, of ethics and for all the concomitant values arising therefrom.

In conjectures and Refutations Popper describes how Kant led his retired life in seclusion? in the Prussian provincial town of Konigsburg but was buried like a king when he died. In stating the reasons for Kant's unexpected royal burial, Popper actually pays his tributes to those essentially 'human' values for which Kant lived and with which his persona was identified in the memories of the people of Konigsburg.....'those bills tolling for Kant carried an echo of the American and French revolutions—of the ideas of 1776 and 1789. I suggest that to his country-men Kant had become an embodiment of these ideas. They came to show their gratitude to or teacher of the Rights of Man, of equality before the law, of world citizenship, of peace on earth, and, perhaps most important, of emancipation through knowledge.'[2]

Thus Kant, as projected by Popper is the first philosopher to have recognized the primacy of man in knowing and in acting. Man has autonomy whether in the realm of knowledge or in the realm of ethics. Kant's quest for freedom substantiates Popper's thesis that the nature of knowledge is incremental; it grows through objections raised against previous knowledge and through seeking answers to them. As Kant explains in one of his letters[3]

1. *Ibid.*
2. *Ibid.*, p. 175.
3. To C. Garve, 21st September, 1798 as quoted by Popper in C. & R., p. 177. 'My starting point was not an investigation.

that it was his solution to a major problem in cosmology and the reaffirmation of it which he received from Newton's theory[1] that led him to his own theory of knowledge and to his critique of Pure Reason. Kant was faced with the intriguing problem (which Popper says, has to be faced by every cosmologist), whether the earth had a beginning in space and time, or whether it did not have such a beginning. Kant found to his surprise that he could produce equally valid proofs for both of these possibilities. Logically, any one of the two has to be correct, although it is impossible to decide rationally which one is. Such a clash of proofs Kant called an 'antinomy'. In the face of the deadlock created by such antinomies, Kant concluded[2] that space and time are pure concepts. They are applicable only to objects of our sense—experience. Since the whole universe has never been experienced by us at one point of time, our mental categories cannot be applied to it. As Kant wrote in his critique, 'the limits of sense experience are the limits of all sound reasoning about the world.'[3] Reasoning does not work in vacuum. It works only when supplied with sense-date. Knowledge is produced only in union with mind and experience. Since space and time are parts of the structure of reasoning, they are not parts of the real empirical world of things and events. Thus they are very elusive and cannot be understood as such. Nevertheless, as elements of our mental outfit, they belong to our apparatus for grasping the world, they are our instruments of observation. For, in observing things and events, we, intuitively and immediately locate them in a context of space and time. Thus space and time may be described as jointly making a frame of reference for experience which in itself is not based upon experience but is unconsciously used in experience. This spatiotemporal framework is indispensable for every experience. We perceive or understand every experience in its light. But as has been mentioned earlier, space and time are inactive mental concepts. They come to life only when they get mingled with the physical world through sense-experience. This is why, argued Kant, we get into trouble when we apply the ideas of space and time to an area which transcends all possible experience. The universe as a whole is one such area. the wholeness of the

1. Prolegomena, end of section 37. Quoted by Popper in C. & R., p. 180.
2. Prolegomena, end of section 37, 518 ff. 'The Doctrine'.
3. Kant, in the Critique of Pure Reason as told by Popper in Conjectures and Refutations, p. 180.

universe has never been part of our cognitive experience. It is pure idea, defied by all experience. This is why when we apply the twin elusive ideas of space and time to an even more elusive, totally unknown idea of the wholeness of universe, we get into difficulties.

To these ideas of his, Kant gave the ugly and misleading name, 'Transcendental Idealism'.[1] He soon regretted this choice.[2] because it made people think that he was an idealist who denied the reality of physical things : that he took physical things to be mere ideas. Kant protested but in vain. He came to be respected as the father of German Idealism. Popper suggests that it is time to rectify this wrong,[3] because Kant always insisted that the physical things in space and time are real. The title of his Critique was actually chosen by him to mount an attack on the wild and obscure metaphysical speculations of the German Idealists. For what the Critique criticizes is pure reason; it criticizes and attacks all reasoning about the world that is 'pure' in the sense of being untainted by sense experience.[4]

Kant's argument against pure reason was that any pure reasoning about the world will logically land us into antinomies like the one mentioned by him about the origin of the universe. Stimulated by Hume, Kant wrote his Critique to establish[5] that the limits of sense experience are the limits of all sound reasoning about the world.

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1. Popper, Conjectures and Refutations, p. 179.
2. Kant, Prolegomena (178), as quoted in C. & R., p. 179.
3. Popper Conjectures and Refutations, p. 179.
4. *Ibid.*
5. See Kant's letter to M. Herz, of 21st February 1772, in which he gives, as a tentative title of what became the first *Critique*, 'The Limits of Sense Experience and of Reason'. See also the Critique of Pure Reason (2nd edn.), pp. 738 f. (bold as per Popper) : *'There is no need for a critique of reason* in its empirical use; for its principles are continuously submitted to tests, being tested by the touchstone of experience. Similarly, there is no need for it within the field of mathematics where its conceptions must be presented at once in pure intuition [of space and time].....But in a field in which reason is constrained neither by sense-experience nor by pure intuition to follow a visible track namely, in the field of its transcendental use.....there is much need to discipline reason, so that its tendency to overstep the narrow limits of possible experience may be subdued.....as quoted by Popper in C. & R., p. 179-180.

As has been said earlier, Kant's faith in his theory that time and space are intuitive frames of reference for sense-experience was reaffirmed when it solved Kant's another major problem of the validity of Newtonian theory. This theory was the first really successful scientific theory in human history. It was not only real knowledge but knowledge beyond the wildest dreams of even the boldest minds, for the precision and the sweep of its predictions were mind-boggling. Before Kepler and Newton the planets had escaped all efforts at precise description thereby baffling the scientists. But now was a theory which explained precisely not only the movements of 'all' the stars in their courses, but with equal precision, all the movements of everything on the earth, from waves and tides to projectiles; and from falling apples to pendulum clocks.[1]

Kant, like all other contemporary physicists, believed unflinchingly in the absolute truth of Newton's theory. Nevertheless, he alone was irked by one question again and again : what is the basis of its predictions—so versatile but so exact? He could not somehow reconcile to the idea that a theory with such wide-ranging and precise predictions could be based on mere observation, as the inductionist philosophy of science of his days would make him believe. Kant first approached the problem with the status of geometry in mind. Euclid's geometry, he argued, was not based upon observation but upon man's intuition of spatial relations. Similarly, Newton's theory, though confirmed by observation, was not the result of observation, but rather the result of our intuitive ways of thinking as imposed on the sense date, of our mental ability to systematise our observation and to digest it according to own laws. Thus not mere accumulation of observation, but our own intellect, or what Popper says, 'the organization of the digestive system of our mind, which is responsible for our theories.'[2] Nature, as is revealed in science, with all its laws and regularities, is the product of the assimilating and ordering capacities of the mind. In Kant's own striking words, 'Our intellect does not draw its laws from nature, but imposes its laws upon nature.'[3]

1. Based on Popper's text in his Onjective Knowledge, p. 211.
2. Popper, C. & R., p. 180.
3. Kant, Prolegomena, end of section 37. Kant's footnote referring to Crusius is interesting : it suggests that Kant had an inkling of the analogy between what he called his 'Copernican Revolution' and his principle of autonomy in ethics as quoted by Popper in C. & R., p. 180.

The reciprocity of reasoning and sense-experience which was suggested by Kant while solving his own cosmological antinomies, was developed by him into the supremacy of reason in order to ascertain the real basis of Newton's theory. The two epistemological stands may seem mutually ambivalent; nevertheless, the former hypothesis contains the potential for the latter.

This latter theory was Kant's 'Copernican Revolution' as he proudly called it in his Critique of Pure Reason. It was, truly speaking, a revolution because it amounted to a paradigm shift in epistemology and philosophy of science. The prevailing paradigm was that of induction. It signified the active predominance of sense-data and the passivity of mind usage in the attainment of knowledge. Kant's thesis, however, of the mental frameworks of sense perception and the primary role of the former in producing our knowledge of nature virtually established the supremacy of mind and the consequent subservience of the sense-date supplied to it by nature. It meant that Kant refuted the paradigm of induction and instead explained the nature of knowledge, especially that of scientific knowledge with the deductive paradigm.

By the term, deductive paradigm, is here meant a mind-centric or an observer-centric theory of knowledge. What Kant intended was that in our attempt to know nature we must give up the idea that we are passive observers, waiting for nature to impress its regularity upon us. Instead we must think that while receiving the sense-date provided by nature, we actively impress the order and the laws of our intellect upon them. The mind accepts, on its own terms, the information furnished to it by nature and projects itself in its knowledge of nature. As Popper says, Kant meant that, 'our cosmos bears the imprint of our minds.'[1] Kant successfully harnessed the suggestions inherent in Copernicus theory in order to solve his own problems and brought about, in turn, as great a revolution in both the terms or only the latter will suffice? epistemology and philosophy of science as Copernicus effected in astronomy.

A revolution as it was, the Kantian episode signified a lot to Popper, even more than what Kant read into it, for it validated many of Popper's theses regarding the history of science and the nature of scientific knowledge. Firstly Kantian episode revealed

1. Popper, Conjectures and Refutations, p. 181.

that the philosopher could radically restructure the epistemological assumptions of his times only by challenging the prevailing ones and posing his own daring presumptions instead. Secondly, by his emphasis upon the role played by the observer, the investigator or the theorist, in the job of knowledge- manufacturing, Popper thinks that Kant gave a lasting orientation not only to philosophy but to physics and cosmology as well. Popper says, 'there is a Kantian climate of thought without which Einstein's theories or Bohr's are hardly conceivable; and Eddington might be said to be more of a Kantian in some respects, than Kant himself'.[1] Thirdly, and most importantly, inspite of his reservations,[2] Popper appears to be more Kantian than any other philosopher. In fact, Kant provides a point of departure to Popper's theory of critical rationalism, and then to his logic of scientific discovery. Fourthly Popper extols as highly meaningful Kant's position in the Critique that the experimenter must not wait till it pleases nature to reveal her secrets, but that he must question her.[3] He must cross-examine nature in the light of his doubts, his conjectures, his theories, his ideas and his aspirations. Popper says that, 'Here, I believe, is a wonderful philosophical find. It makes it possible to look upon science,....., as a human creation, and to look upon its history as part of the history of ideas, on a level with the history of art or of literature.'[4] While explaining the significance of Kant's ideas Popper seems to suggest his own theories. An evidence of this is found when Popper says that Copernicus own revolution made man irrelevant, but Kant brought him in the centre by making him the creator of his knowledge. As per Popper, this is Kant's great tribute to the dignity of man as a knower. It is man who creates at least in part, the order he finds in the universe; it is we who create our knowledge of it. Kant has made man a discoverer : and discovery is a creative art, says Popper.[5] In this way Kant restores that dignity of man as a knower which was denied to him by his Baconian predecessors.

1. Popper, Conjectures and Refutations, p. 181.
2. *Ibid.* 'Even those who, like myself, cannot follow Kant all the way.....
3. Kant, The Critique of Pure Reason, 2nd edn., pp. XII f.; if especially the passage : The physicists.....realized that they.....had to compel Nature to reply to their questions, rather than let themselves be tied to her apron—strings, as it were. As quoted by Popper in C. & R., p. 181.
4. Popper, Conjectures and Refutations p. 181.
5. *Ibid.*

And so has Kant restored the dignity of man as a doer too, is the rightful point made by Popper. And he rightfully comments that the basic idea of Kant's ethics signifies another Copernican Revolution in morality, parallel to the one created by him in philosophy. His fundamental idea lies in his doctrine of autonomy. It is the doctrine that howsoever exalted an authority may be, it is ultimately man's responsibility to judge whether the command is moral or not, whether it should be obeyed or not. The essential point Kant made was that there is an authority of man's moral conscience which lies within him and which is higher than any outward authority. Popper holds that Kant made man the lawgiver of ethics just as he made him the lawgiver of nature. And in this way Kant restored to man his central position not only in his moral but in his physical universe too. Kant humanized ethics just as he had humanized science is Copper's justified comment.[1] Going back in history, Popper compares Kant's moral ideas to those of Socrates.[2] Both stood up for freedom of thought. Freedom to them was not just absence of constraints; it was a way of life. With Socrates a new idea of the free and self-sufficient man came into being. To this Socratic ideal of man's moral self-sufficiency which is part of the western heritage, Kant attributed a new meaning in the realm of knowledge and ethics, *i.e.*, the autonomy of man as a knower and as an actor. Moreover, Kant enlarged this ideal of an autonomous individual into the ideal of a community of autonomous men.

This is Popper's presentation of Kant's contribution to western philosophy. Kant brought about a revolution in philosophy by questioning the cosmological and the Newtonian theories of his times. He anticipates Popper's thesis that science grows by posing problems and solving them. Like Popper, Kant also believed that the onus lies with the experimenter that he should take the lead and start cross-examining the prevailing theories about nature in the light of his doubts and his conjectures. The primacy of the investigator in Kant leads to his anthropocentic view of knowledge. His doctrine of man's autonomy in ethics means a man-centric picture of morality. In knowing and in doing Kant strives to restore the same centrality to man in his universe which is also the guiding spirit for Popper. If the latter's philosophy of science is concerned with salvaging the dignity of

1. Based on Popper's text in Cojectures and Refutations, p. 181.
2. Popper, Conjectures, p. 182.

man as a knower, his socio-political philosophy is concerned with salvaging his dignity as a doer. Apart from this, and to use Popper's own words, Kant has 'prepared the climate' for several significant ideas in Popper. Kant's idea of the decisive role of the knower in knowledge gave full scope to Popper to develop his own that knowledge is a human creation, and that knowledge too has a history which should be viewed as the history of ideas; that as creator of his knowledge man actually is a discoverer of the world he knows through it; that discovery is a creative art and should be envisaged at par with art or literature.[1]

Similarly Popper's own anti-authoritarian ethics in which every individual is free to criticize his institutions and suggest realistic solutions to them seems a natural enhancement of Kant's ideas of man's moral autonomy and his concomitant moral responsibility for free decisions. Kant's criticism of pure reason fits well with Popper's criticism of essentialism. Kant believed in the reality of physical things and events. This empiricism of his is very close to Popper's concept of world. Kant's compromised rationalism paves the way for Popper's critical rationalism. Whether it is empiricism, rationalism or humanism, Kant's and Popper's ideas belongs to the same genre. In almost all important respects Kant anticipates Popper.

Kant seems to have prepared the ground work for Popper. He has set the orientation for Popper's entire intellectual endeavour. Kant has elaborated upon the rational-human theme of Enlightenment, and Popper has elaborated upon Kant—picking up the strings from where the latter had left them. Popper has virtually completed the task of his precursor. A true intellectual inheritor of Kant, Popper has been rightly named by critics as a neo-Kantian.

The Baconian and the Cartesian Myths : Popper's Criticism of them.

As has been clear at the outset, Popper's epistemology or theory of knowledge is a logical outcome of his metaphysical moorings. In the course of bringing his own positive ideas into sharp relief, Popper criticises various traditional misconceptions nurtured in this field since long. One such grave misconception is that of the sources of knowledge which Popper calls the Baconian or the Cartesian myth in epistemology. The question of the origin

1. Popper, Conjectures and Refutations, p. 181.

of knowledge is irrelevant. When all knowledge is conjectural, a guesswork, it is inmaterial whether or not it originated in observation. As is evident from the history of science, many observation based theories as well as many reason based theories have been proved false. Thus neither history nor logic justifies any special status to observation. In fact, all sources are important, but none has final authority. The very issue of the origin of knowledge is a misconceived one for any theory of knowledge. An epistemology should not begin with such futile question as to what should be the source of our knowledge. Such questions are wrong too because they misdirect the whole epistemological inquiry and distort the nature of knowledge, and as Popper points out, has many unwanted, rather pernicious implication's for morality and politics.

The two important intellectual traditions of the West have unfortunately been inflicted by this wrong question from the very beginning, is Popper's bold assumption. They have become prejudiced in their choice of problems, their methodologies, their answers, and most important of all, their moral and political message. All these errors have been committed with the best of intentions, hard work and commendable intellectual abilities.

The intellectual traditions of the West criticized by Popper are the neo-rationalist tradition starting with Descartes and the empirico-rationalist tradition of modern science founded by Bacon. It is highly brilliant and original on the part of Popper to have unveiled a hitherto unnoticed unity between the two divergent intellectual foundations of the Western world.

The question 'what is the source of knowledge' is itself the product of a host of other assumptions. One assumption is quite obvious : It is a search for the authoritative sources of knowledge. The rationalist tradition views reason as the authoritative source of knowledge. Parallel to it, yet converging on this point, the empirical tradition recognizes senses *i.e.* observation as the reliable means of knowledge of nature. This logically presupposes an even more important faith in an objective truth about the world and an equally important faith in the knowability of that truth—that the truth is not hidden, it is obvious thus attainable by human beings if only they reach out to it with pure, unprejudiced intellect or observation. Popper calls this the theory of manifest truth. There are many fallacies in this theory according to Popper but they shall be dealt with later. A theory which is akin, albeit complementary

to it is the conspiracy theory of knowledge. When both of them are combined together, the logic appears that if the otherwise obvious truth does not dawn naturally upon human beings it is because of some impurity, some perversity or some bias of human intellect or senses. Since truth is natural, ignorance is acquired and unnatural. The crux of the matter is that the ignorant is not to be held responsible; his ignorance is due to a conspiracy made by some evil forces. Although not directly related but highly relevant is Plato's distinction between knowledge and opinion; truth and ignorance. It seems that right from Plato there existed a distinction between truth and falsity, the identification of knowledge with truth, of ignorance with untruth and the grounding of the whole enterprise in the distinction of reliable and unreliable sources of knowledge.

This set of theories has many defects : Truth is erroneously identified with the source of its inquiry. It is the source which is the guarantee of truth and the authenticity of knowledge. Popper's thesis is that no source can lead to the whole truth. Thus, against the concept of the knowability of truth, Popper presents the opposite concept of the unknowability of truth. And against the glorification of reason and sense as the authoritative sources of knowledge, Popper claims that knowledge can have any number of sources but none has authority. In this manner, Popper disengages the key alignment of truth and its sources. The very important question of the source of knowledge, an inaugural question of traditional epistemologies, has been made simply insignificant by Popper. He says, quite rightly, that the source of knowledge or the fact how an idea took birth is a fact of psychology. It may be of interest to a biographer, but has nothing to do with the objective merit of that idea or, in general terms, the authenticity of that idea. So far as the relation between truth and knowledge is concerned, Popper criticises the identification of truth with knowledge and of falsehood with ignorance. He says that truth is at best a regulatory idea of knowledge, its purpose or its ideal but never a fully attained fact with it. Knowledge only attains truth in degrees, that too not absolutely but relatively vis-a-vis other theories. The concept of truth is a highly original one in Popper and shall be amplified in a separate section on Tarski's concept of truth. Thus Popper disengages the alignment between truth and its reliable epistemological sources; makes truth independent of its sources; recognizes several sources of

knowledge but rejects them all as irrelevant for epistemology, makes final truths the ideal of knowledge but only partial or relative truth its actual possible achievement.

Although not pointed out by Popper, an objection is relevant enough to be raised in this context. The rationalists and the empiricists equally claim to own the only authoritative source of truth. In other words, each asserts its superiority and tacitly condemns the other. The question is : How can there be two 'the only' source of truth. Popper's epistemology does not raise this question because it labels all of them as equally insignificant.

Rationalism, an otherwise erroneous tradition, seems to Popper to have at least one idea of great value : that truth is above human authority.

In fact, both the traditions have been engendered by Renaissance. True to the spirit of the great movement, they were a revolt against authority and conversely, signified faith in man's capacity to know the truth. Every man had reason and the senses to guide him to truth.

Induction : Popper's logical arguments against it.

The purpose of Baconian science is to discover the truth about nature through observation. Induction is the universally accepted method for this purpose. It is the sine quo non of science, for science as popularly believed, is essentially its method and method is nothing except induction. For formulation of general laws on the basis of observation and their verification on the basis of experiment is the method of induction. It is a theory of the origin and validity of scientific laws. These laws are great secrets about nature, assiduously discovered by man with the wonder key of *i.e.*, induction

Many, many years ago some awkward questions about the logic of induction were raised by Hume. They are unanswered even to this day with the result that induction after Hume, came to mean an irrational but a deeprooted, habit with the scientist. Its hold upon the scientific community is because of its utility. It is only technique in their hands for knowing the secrets of nature and thereby controlling it. The rationale of induction was not reason but psychology. But, ever since the days of Hume, induction has remained a skeleton in the cupboard of philosophers. They have never got reconciled to the unrational, infirm foundations of a huge edifice that is science. It was as

though the whole giant structure was hanging in the air; yet scientists seem hardly to take notice of the discomfiture of the philosophers. They go on happily with their methods. What matters to them is the fact that science works, gives spectacular results. Every new law discovered by science means another victory of man over nature. Induction in the hands of the scientists is a hen that lays golden eggs.

Popper's seminal contribution to philosophy of science has been the solution of the logical problem of induction. He has solved it by the principle of falsifiability. Popper begins with the logical asymmetry between verification and falsification. He says that any number of verifying evidences cannot prove an assumption but even a single negative evidence can falsify it thus, if Hume is right and no conclusive verification can be made, at least conclusive refutation is always possible. Thus, the only logical relation between a general statement (theory) and a particular statement may possibly be a negative one, so that an unfavourable evidence may at least prove a theory wrong. Theory and observation are two pillars of scientific method. Inductive method was weak in the sense that the relation between the two was illogical. Popper's idea of falsification roots out this logical weakness from the relation; uses observation to criticize and overthrow theories. Secondly, the inductive relationship between theory and observation is causal : The observational date when accumulated, manifests certain regularities which go in to make a theory. Popper has "discarded" this relationship as fallacious. Glorification of observation as the only authoritative source of true theories and the sole criterion of the latter's verification is a typical feature of the method of induction. Popper's thesis is that there are various other sources of scientific theories but none have final authority. Glorification of any one source is therefore, basically incorrect. Moreover, the question of the origin of a theory is a subjective element. It only states how a scientist or a philosopher must have arrive at a particular theory. Genesis has nothing to do with the merit of idea. The quality of a theory is its unimaginative boldness in solving the problem at hand. In other words, it is the objective, problem-solving capacity of a theory that is important. Induction, according to Popper, suffers from psychologism. It focussed on the irrelevant psychological aspect of a theory rather than on its objective merit. The novel idea of falsification is of central import in Popper's thought, for it tends to undermine

many other key assumptions of induction. If theories are potentially refutable by actual observation, they can no more be viewed as 'true', their falsifiability, their error-prone nature has to be somehow presupposed. It is another thing that such a demand is something unheard of, too strange and too devastating a blow to the readers indoctrinated by the traditional epistemological ideals of true and genuine immutable theories of nature. And it is here that Popper comes to help with his ideal of theories as conjectural. If theories are to be invented with the purpose of knowing the truth, but cannot overrule error in the process, they can be called nothing else but hypothesis or conjecture. Thus, even if verified thousand times, theories are not ultimate truths; they can be proved wrong. As has been said earlier, induction conceives of truth as something obvious which can be grasped correctly by impartial observation of Popper's concept is that truth is the final cause of scientific inquiry but it can be known as such.

Popper says that there has been serious misconceptions about the nature of induction among the learned community of yore and the present times. It identifies induction with a subjectivist theory of deduction. Induction, it thinks, is a logical belief like deduction. Popper is very categorical about his opinion that induction is a myth; it does not exist at all; it should not be therefore, bracketed with the law of deduction which very much exists, and has an objective existence, not a subjectivist one as is largely believed. In his essay, Induction; Deduction; Objective truth, Popper states his reasons against this prevalent misconception. He cogently registers his conclusions that induction is a mere belief, not a venerated logic of science as is commonly believed, and that on the contrary, deduction is of a sound objective nature. However, thus nature can be well understood with the help of the correspondence theory of truth as revived by Tarski. This essay is a strong argument from Popper against, the whole tradition of 'belief philosophers'.[1]

In an effort to present Popper's aforestated ideas, his exposition of Tarski's theory of truth as correspondence to facts will be mentioned first, and then his explanation of the objective nature of deductive inference. Popper's logical refutation of the preponderating subjectivist thinking on the nature of knowledge shall be mentioned next. This will be rightly followed by his well-reasoned judgment against the very existence of the

1. Popper, Unended Quest. 'I am not a belief philosopher' is Popper's statement about himself on p. 145.

subjectivist theory that is induction.

The theory of truth as correspondence to facts was originally formulated by Xenophanes. This ancient theory was eclipsed in history by various untenable but popular theories of truth. To Tarski goes the credit of rescuing the theory from oblivion and formulating it in a new form.

Tarski's theory of truth

The great merit of Tarski's theory of truth as correspondence to facts is that it views truth as something objective, as an attribute of theories, rather than as an experience or belief or something similarly subjective. It is also absolute, for it is not relative to some set of assumptions (or beliefs); we may ask of any set of assumption's whether or not they are true.

Tarski differentiates between a fact and the statement of a fact. A theory contains some statement about a fact. It means that the fact is something parallel to a statement of it; it lies outside the periphery of that statement; and the truth of the latter is decided by virtue of its conformity or correspondence to that fact. Thus facts become a point of reference for the statements of a theory. There appears to be in Tarski a category of facts and a category of statements. In fact two parallel sets of languages are required : one, a language of facts, as found in the world and second, a language of statements. The first one is a language that can refer to statements and describe facts. It is called the metalanguage. It is in this language that one can speak of correspondence between statements and facts. The statements can be referred to it in order to ascertain the validity of their content.

The second language is the object language. This comprises all the statements of a theory. It is this language about which we talk in the metalanguage.[1] If the object language conforms to the metalanguage, it is true, otherwise not. 'The characteristic thing about a metalanguage is that it contains (metalinguistic) names of words and of statements of the object language, and also (metalinguistic) predicates, such as 'noun (of the object language)' or 'verb (of the object language) or statement (of the object language)'. If a metalanguage is to suffice for our purpose it must also, as Tarski points out, contain the usual means necessary to speak about at least all those facts about which the object language

1. Based on the text of Popper's Objective Knowledge, p. 314.

can speak.' Popper gives a simple example : 'the grass is green' is true if and only if the grass is green.'[1]

Here 'the grass is green' is the object language and 'if and only if the grass is green' is a metalanguage containing a fact. In order to judge the veracity of the statement, of the object language 'the grass is green', Tarski insists that its fidelity to the metalanguage, 'if and only if the grass is green' be checked. If the fidelity is there, the object language is true. It is this element of fidelity or conformity which Tarski emphasises in his theory of truth as correspondence to the facts.

However, Tarski's is not just a theory for verifying such simple sentences. Its real worth lies in its success at revealing the fallacy or the validity of such logical situations as found in deductive influences. It is this worth of the theory which Popper avails for unveiling the typical objectivity and absoluteness of deductive validity.

Deduction as conceived by Popper

What Popper wants to emphasize is that, besides the syllogistic logic, the concept of truth and falsehood is fundamental to the meaning of deduction. This concept of truth is objective, says he[2] and not only so, it is tacitly presumed by the law of deduction. However, the subjectivist epistemology has always insisted that it is our belief or intuition about the deductive and inductive inference that makes them valid. Popper has striven hard to distinguish the subjective origin of knowledge from the objective nature of knowledge and to dismiss the former as insignificant.

The law of deduction is therefore, objective and even absolute. However, objectivity here does not mean that we can always ascertain the truth or the validity of a given statement. If the term "true" can be used only in the objective sense, "then there are many statements which we can prove to be true; yet we cannot have a general criterion of truth. If we had such a criterion, we would be omniscient, at least potentially, which we are not. According to the work of Godel and Tarski, we cannot even have a general criterion of truth for arithmetical statements, although we can of course describe infinite sets of arithmetical statement which are true. In the same way, we may agree to use the term "valid

1. Popper, Objective Knowledge, p. 314.
2. Popper, Unended Quest, p. 143, infra.

inference" in the objective sense, in which case we can prove of many inferences that they are valid (that is, they unfailingly transmit truth); yet we have no general criterion of validity—not even if we confine ourselves to purely arithmetical statements. As a consequence, we have no general criterion for deciding whether or not some given arithmetical statement follows validly from the axioms of arithmetic. Nevertheless, we can describe infinitely many rules of inference (of many degrees of complexity) for which it is possible to prove validity; that is, the non-existence of a counterexample. Thus it is false to say that deductive inference rests upon our intuition."[1]

Thus it can be said that there is nothing subjective about deduction. The truth or the validity of a deductive inference is not decided by our intuition, howsoever we may strongly feel about it. It is decided only by the fact that it (the inference) invariably transmits truth from the premises to the conclusion. That is to say if and only if all inferences of the same logical form transmit truth. This can only be explained as : a deductive inference is valid if and only if no counterexample exists. Here a counterexample is an inference of the same form with true premises and a false conclusion.

In fact, "deduction or deductive validity is objective, as is objective truth. Intuition, or a feeling of belief or of compulsion, may perhaps be sometimes due to the fact that certain inferences are valid; but the validity is objective, and explicable neither in psychological nor in behaviourist nor in pragmatist terms."[2]

Thus it is clear that although it may not be based upon an objective criterion of truth, deductive logic presumes its own version of objective truth. It is not based upon intuition.[3] This meaning of objective truth is successfully explained by Popper with the help of the correspondence theory of truth as rescued by Tarski. In fact the great merit of Tarski's theory is that it helps to reveal very clearly that objective nature of deductive logic which was otherwise concealed beneath the subjectivist jargon of epistemology. This jargon always insisted that it is our belief or intuition about deductive and inductive inferences which makes them valid. As is clear from the preceding paragraphs, Popper is very firmly opposed to this view. Tarski's theory gives an added

1. Popper, Unended Quest, p. 144.
2. Popper, Unended Quest, p. 145.
3. Popper, Unended Quest, p. 144.

force to Popper's opposition.

In a deductive inference, if the premises are true, the conclusion has to be true, that is, the truth of the premises (if they are all true) is invariably transmitted to the conclusion; and the falsity of the conclusion (if it is false) is invariably retransmitted to at least one of the premises. Popper has christened these laws respectively "the law of the transmission of truth" and "the law of the retransmission of falsity.[1] This can also be explained by saying that a valid inference is the one which is true and emanates from true premises as well, but an invalid inference is the one which is objectively false (inspite of getting originated from true premises) and makes one of the premises also false in turn. This false inference is a counterexample. Popper gives an example.

"All men are mortal. Socrates is mortal.

∴ Socrates is a man."

Let Socrates be here the name of a dog. Then the premises are true but the conclusion is false. Thus we have a counterexample and the inference is invalid.[2]

These laws are fundamental to the theory of deduction. However, an understanding of these laws is greatly facilitated by Tarski's correspondence theory as mentioned above. The only requirement of the theory is that "truth" or "true" should be replaced by Tarski's "correspondence to the facts" and "correspond to the facts". Thus it can be said that the truth of the premises (if they correspond to the facts) is invariably transmitted to the conclusion; and the falsity of the conclusion (if it does not correspond to the facts) is invariably transmitted to at least one of the premises.

Now Popper's point is that the deductive syllogism becomes tenable not only because the truth of the premises gets faithfully transmitted to the conclusion, but also because that 'transmitted truth' conforms to some truth of the world, in Tarski's words, corresponds to the facts as they are in the world. At the same time, another syllogism—the counterexample becomes untenable inspite of the fact that it logically transmits the truth from the premises to the conclusion. Its invalidity is because its 'logically transmitted true' inference clashes with some fact of the outside world. As Tarski would say, it does not 'correspond to the objective As

1. Based upon the text p. 143 of Unended Quest.
2. Popper, Unended Quest, p. 143.

quoted by Popper in his footnote to facts.' As has been mentioned earlier, these facts find their place in Tarski's metalanguage. To return to the invalid inference, even if one dog in the world (and it is an objective fact), carries the name Socrates, there is a counterexample (exception) of that name. The inference gets rebutted by that counterexample, and is termed as false.

Thus to put the whole matter differently, a deductive inference is valid due to two reasons, firstly, because it is internally coherent (derives its content from the premises), and secondly, because it is externally coherent; it corresponds to some objective facts outside itself. However, this external coherence or correspondence is tacitly assumed by the deductive theory. It is this assumption which is brought to the fore by Tarski's theory of truth, means Popper. The meaning of the objectivity of deductive truth thus gets enlarged and clarified.

The fallacy of intuition

Criticizing the subjectivist epistemology, Popper says sometimes our intuition makes us believe in the truth of something. Our native power of reasoning also has some inbuilt disposition towards truth. But our intuitions or our senses do not always tell the truth. The phenomenon of optical illusion proves this. Besides, there is an inverse relationship between our intuitions and their truth content. Our intuitions may be true but every truth need not figure in our intuitions, or that we need not feel very strongly about every truth. Secondly, nothing becomes true just because we have a very strong intuition about it, or that something appears compelling or self-evident to us, or because the opposite is inconceivable. Thus to conclude, intuition and truth are identical not necessarily but accidentally, the reason being that intuition is subjective and truth is objective.

Popper says that he has often expressed this attitude by saying : "I am not a belief philosopher." Indeed, beliefs are quite insignificant for a theory of truth, or of deduction or of "knowledge" in the objective sense. A so-called "true belief" is a belief in a theory which is true; and whether or not it is true is not a question of belief, but a question of fact. Similarly, "rational belief", if there can be said to be such a thing, consists in giving preference to what is preferable in the light of critical argument. So this again is not a question of belief, but a question of argument,

and of the objective state of the critical debate.[1]

The myth that is induction : Popper's Logical Argument against it.

As for induction (or inductive logic, or inductive behaviour, or learning by induction or by repetition, or by "instruction").[2] Popper asserts in his Conjectural Knowledge[3] that there is no such thing; and that, if he is right, this denial of his is enough to solve the problem of induction. Other problems are still left which may nevertheless be called problems of induction, such as, whether the future will be like the past. However, this problem is not very stirring and can be thus solved : the future will in part be like the past and in part not at all like the past.'[4]

Unfortunately, a good many philosophers do not agree with Popper. Beginning from J.S. Mill, modern names like P.F. Strawson, Nelson Goodman, Rudolf Carnap and Lakatos have replied differently from Popper to Hume's verdict that induction is illogical yet inevitable as a mental habit with us.[5] Popper terms all these opinions singularly as the "fashionable reply" to Hume. It is that induction is, of course, not valid, because the word "valid" means "deductively valid". Yet the invalidity (in the deductive sense) of inductive arguments does not pose any serious problem; for they are valid in a different sense. Deduction and induction are two parallel types of valid arguments. But the difference notwithstanding, the two have a lot in common. Both argue in accordance with certain well-tried, habitual and fairly intuitive rules.

The alleged commonness in induction and deduction is explained by Popper in these words : "The validity of deduction

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1. *Ibid.*
2. Popper Unended Quest, p. 145.
3. Popper Conjectural Knowledge : MY Solution of the Problem of Induction, 1971, Revue Internationale de Philosophie, No. 95-96, 25 fasc. 1-2, pp. 167-197.
4. Popper, Unended Quest, p. 145.
5. P.F. Strawson, Introduction to Logical Theory (London: Menthuen & Co., 1952; New York : John Wiley & Sons, 1952), pp. 249 & Nelson Goodman, Fact, Fiction and Forecast (Cambridge, Mass : Harvard University Press, 1955), pp. 63-66; and Rudolf Carnap, "Inductive Logic and Inductive Intuition", in Problem of Inductive Logic, ed. by Lakatos, pp. 258-67, particularly p. 265 (see no. 41 above).

cannot be validly proved, for this would be proving logic by logic, which would be circular. Yet such a circular argument, it is said, may in fact clarify our views and strengthen our confidence. The same is true for induction. Induction may perhaps be beyond inductive justification, yet inductive reasoning about induction is useful and helpful, if not indispensable. Moreover, in both the theory of deduction and the theory of induction, such things as intuition or habit or convention or practical success may be appealed to; and some times they must be appealed to."[1]

After stating this "fashionable view" Popper criticizes it. And in criticizing, he gives the same argument he has given while explaining the meaning of validity in deduction in the beginning of his essay : a deductive inference is valid if no counterexample exists. This provides us with a method of objective critical testing. Whenever we come across a proposed rule of deduction, we can test it by trying to construct a counterexample. If we succeed, the inference is invalid whether or not it is held intuitively valid by some or even by all the people. Since there are objective tests, and in some cases even objective proofs are available to us (if Socrates is some dog's name, the inference that Socrates is a man is invalid), subjective beliefs, convictions, habits or even conventions—all psychological considerations—become completely irrelevant to the point at issue.

"Now what is the situation with regard to induction? when is an inductive inference inductively "unsound" (to use a word other than valid")? The only answer which has been suggested is : when it leads to frequent practical mistakes in inductive behaviour. But I assert that every rule of inductive inference ever proposed by anybody would if anyone were to use it, lead to such frequent practical mistakes.

The point is that there is no rule of inductive inference—inference leading to theories or universal laws—ever proposed which can be taken seriously for even a minute."[2] Carnap seems to agree with this; for he writes :[3]

By the way, Popper finds it "interesting" that I give in my lecture an example of deductive inference, but no example of inductive inference. Since in my conception probabilistic ("inductive") reasoning consists essentially not in making

1. Popper, Unended Quest, p. 146.
2. Popper, Unended Quest, p. 146-147.
3. Carnap, "Inductive Logic and Inductive Intuition, p. 311.

inferences, but rather in assigning probabilities, he should instead have required examples of principles for probability assignments. And this request, not made but reasonable, was anticipated and satisfied.

But Carnap developed only a system that assigns the probability zero to all universal laws....."Anyway, to my mind such laws—of which there are, in practice, always infinitely many—ought to be given "probability" zero (in the sense of the calculus of probability) through their degree of corroboration may be greater than zero. And even if we do adopt a new system—one that assigns to some laws the probability, let us say, of 0.7—what do we gain? Does it tell us whether or not the law has good inductive support? By no means; all it tells us is that according to some (largely arbitrary) new system—no matter whose—we ought to believe in the law with a degree of belief equal to 0.7, provided we want our feelings of belief to confirm to this system. What difference such a rule would make and, if it makes a difference, how it is to be criticized—what it excludes, and why it is to be preferred to Carnap's and my own argument's for assigning zero probabilities to universal laws—is difficult to say."[1]

Popper admits that "according to Carnap's position of approximately 1949-56 (at least), inductive logic is analytically true. But if so, I cannot see how the allegedly rational degree of belief could undergo such radical changes as from 0 (strongest disbelief) to 0.7 (mild belief). According to Carnap's latest theories "inductive intuition" operates as a court of appeal. I have given reasons to show how irresponsible and biased this court of appeal is in my "Theories, Experience, and Probabilistic Intuitions."[2]

Popper, after mentioning that the inductivist Nelson Goodman[3] also recognizes that 'sensible rules of inductive inference do not exist; finally concludes,

"The best rule I can extract from all my reading of the inductivist literature would be something like this :

'The future is likely to be not so very different from the past.'

1. Popper Unended Quest, p. 147.
2. Popper, "Theories Experience, and Probabilistic Intuitions," *Proceedings of the International Colloquium in the Philosophy of Science, 2 : The Problem of Inductive Logic*, edited by Imre Lakatos, North-Holland Publishing Company (Amsterdam), pp. 285-303.
   As quoted by Popper in his footnote to p. 147 of his Unended Quest.
3. Nelson Goodman, Fact, Fiction, and Forecast, p. 65, (see n. 228 above).

This, of course, is a rule which everybody accepts in practice; and something like it we must accept also in theory if we are realists (as I believe we all are whatever some may say). The rule is, however, so vague that it is hardly interesting. And inspite of its vagueness, the rule assumes too much, and certainly much more than we (and thus any inductive rule) should assume prior to all theory formation; for it assumes a theory of time.

But this was to be expected. Since there can be no theory-free observation, and no theory-free language, there can of course be no theory-free rule of induction; no rule or principle or principle on which all theories should be based.

Thus induction is a myth. No "inductive logic" exists. And although there exists a "logical" interpretation of the probability calculus, there is no good reason to assume that this "generalized logic" (as it may be called) is a system of "inductive logic."[1]

For Popper's theory of corroboration, see in the above mentioned book, end of section 20 above, and also the end of section 33, esp. n. 243 and text.

"Nor is it to be regretted that induction does not exist : we seem to be quite well without it—with theories which are bold guesses, and which we criticize and test as severely as we can, and with as much ingenuity as we possess.

Of course, if this is good practice—successful practice—then Goodman and others may say that it is an "inductively valid" rule of induction. But my whole point is that it is good practice not because it is successful, or reliable, or what not, but because it tells us that it is bound to lead to error and so keeps us conscious of the need to look out for these errors, and to try to eliminate them."[2]

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1. Popper, "Theories and Probabilistic Intuitions", Proceedings of the International Colloquium in the Philosophy of Science, 2 : The Problem of Inductive Logic, edited by Inure Lakatos, North-Holland Publishing Company (Amster dam).
2. Popper, Unended Quest, p. 148, and above.

SCIENTIFIC METHOD

The Historical Roots of Popper's Theory of Knowledge.

Hitherto the treatment of Popper's epistemology was essentially analytical and expository. However, a historical dimension will now be added to it. The reason essentially is that for the two important traits of his theory of knowledge Popper draws historical support from the Presocratic Greek intellectual tradition. In fact, the presocratic story is really valuable in the sense that it furnishes historical testimony in favour of Popper's deductive theory of scientific knowledge which *ipso facto* goes against the Baconian version of that theory. As is proved by his essay, Back to the Presocratics in his Conjectures and Refutations, the story is a potent weapon in Popper's hands to volley his initial attacks on induction. How Popper appears to have done this will be dealt with later; only after mentioning the two points about Popper's scientific epistemology. They are, firstly, the cosmological nature of scientific problems, and secondly, the nature of knowledge as a critical tradition.

Genuine Scientific Problems : Cosmological.

If problems provide the dynamics for science as well as for knowledge in general, what type of problems are they precisely? The well-known Baconian answer is : observational. It simply asserts that it is from observing simple objects that science began, and accordingly a genuine philosophy of science is one that glorifies observation as the only authoritative source of scientific knowledge. The typical grassroot epistemological problem in the inductive system is, for example, 'how can I know that the thing I am perceiving is an orange? Popper rejects this question. His reason is obvious. The problem is too trivial to arouse genuine interest within any inquirer. In a general way, it has already been stated that for Popper, problems should be profound rather than commonplace in order to deserve scientific status. This element of profundity should now be elaborated. What Popper precisely means is that only cosmological problems are the real problems for philosophy as well as for science. He says that neither philosophy,

nor science, nor even epistemology ever started with dull commonplace problems as presumed by Bacon. The presocratic Greek philosophers, from Thales to Plato, were among the oldest philosophers of the Western civilization. The nature of their philosophy and the questions that lay at its roots are an evidence that the first truely interesting problems were cosmological. Instead of asking, 'how do I know that this is an orange, they simply asked, 'how do we know that the world is made of water? or 'how do we know that the world is full of gods? others were interested in the phenomenon of change and in the shape and position of the earth. Popper is clearly of the opinion that the real worth and appeal of any philosophy and, for that matter, of science too, lies in the cosmological scope of its problems and the boldness with which it seeks to solve them. Accordingly, any real value of an epistemology lies in its simplicity and in it of cosmological knowledge. (In fact Popper clarifies that cosmology does mean understanding the world and ourselves who are part of that world and of course our knowledge of that world) Thus Popper intends to include even epistemology within the purview of cosmology. It should be noted that it is here that we get the first inkling of Popper's condemnatory attitude towards all non-cosmological problems and philosophies *e.g.*, the linguistic and the normative ones. (Popper names them pseudo philosophies).

Popper's Theory of Scientific Method : Statement of the Problem

A Historical Survey.

The history of science reveals that is is confronted with problems which previous theories cannot explain. This is known as the problem—situation, the solution of which demands a new theory; which in turn may be confronted with another problem-situation that necessitates explanation in terms of another new theory. Hence no theory in science is final and valid for all times and situations. Science is, therefore, a series of attempts in advancing hypotheses and testing their falsifiability. It is in this sense that all knowledge in science is incremental and all theories tentative guesses. The history of science is the history of conjectures and refutations. That sets the temper of science as being an immensely critical enterprise. This is the core of what Popper has said so elaborately on science and the scientific

method.

> "Science is not a system of certain or well-established statements; nor is it a system which steadily advances towards a state of finality. Our science is not knowledge (episteme) : it can never claim to have attained truth, or even a substitute for it, such as probability.
>
> Yet science has more than mere biological value. It is not only a useful instrument. Although it can attain neither truth nor probability, the striving for knowledge and the search for truth are still the strongest motives of scientific discovery."[1]

The above quoted lines are significant because they contain all the important ideas of Popper's philosophy of science; the most important among them being his concept of truth and the role assigned to it by him. Despite serious difficulties, as shall be mentioned further on, Popper insists that he has never changed his mind about this, and that he has developed his ideas about the nature of truth mainly under the influence of Tarski. But as the abovestated quotation from his first essay in philosophy of science makes evident, Popper was very clear from a much earlier period that truth was the goal of scientific research. That is why even twenty years later we find him once again arguing against instrumentalism—the doctrine that the only purpose of theories in science is prediction, and that the value of theories and therefore of science lies in its workability and not in their ontological merit to tell the truth about nature—and in support of the doctrine of Galelio that 'the scientist aims at a true description of the world, or of some of its aspects, and at a true explanation of observable facts.'[2]

This is again corroborated by Popper in the following extract from Objective Knowledge, his latest major work in this field :

> "Our main concern in science and in philosophy is, or ought to be, the search for truth.'[3]

Popper's problems regarding the philosophy of science and the range of his solutions to them are all determined by this conviction of his. Conversely, if he had been able to accept instrumentalism or any other theory which held that science was not essentially a search for truth, the whole scene would have

1. Popper : Logic of Scientific Discovery p. 278.
2. Popper : Conjectures and Refutations p. 114.
3. Popper : Objective Knowledge, p. 319.

changed substantially. But now that he hasn't changed, Popper seems to be directed by two simple but ambivalent ideas : that science is truth-seeking and that science can never attain logically sufficient grounds for claiming to have found it.

Hume was sensitive to this problem apart of which has been cogently expressed in a classic statement by him in the famous third part of Book One of his Treatise of Human Nature. Hume had argued in defence of : 'These two principles, that there is nothing in any object, considered in itself, which can afford us a reason for drawing a conclusion beyond it; and, that even after the observation of the frequent and constant conjunction of objects; we have reason to draw any inference concerning any object beyond those of which we have had experience.[1]

No doubt these principles were ignored, and Hume had to give a long psychological explanation as to why they are so difficult to accept. However, the essential logical point is simple and irrefutable, *i.e.*, that from the truth of the statement that this particular *X* is a *Y*, or even that every *X* hitherto observed has been a *Y* (granted that *X*-ness does not logically entail *Y*-ness) nothing follows about whether or not any other (hitherto unobserved) *X* is a *Y*, or to be exact, whether every *X* is a *Y*.

This problem has been stated in the following fictitious but hilarious exchange :

> Woman : Professor, professor you must help me. My husband uses an inductive argument to justify the use of inductive arguments.
>
> Professor Hume : That's terrible How long has he acted this way?
>
> Woman : As long as I can remember.
>
> Hume : Then why didn't you see me sooner?
>
> Woman : I would have, but we needed (the conclusions of) the inductive arguments.
>
> Hume : I am afraid I need them too.[2]

This logical point taken along with the basic principles of an empiricist theory of knowledge, gives rise to the time honoured 'problem of induction'. If observation, *i.e.*, the disciplined use of sense experience, is our only means of finding out about our world

1. Hume : A Treatise of Human Nature p. 139.
2. John L. Casti : Paradigm's Lost. Images of Man In the Mirror of Science, page, 20.

and since all such experiences can only be of particular things in particular situations, our science in the sense of a systematic or organized body of knowledge about the world, can be developed only by the use of such observations of particulars. But such observations, however patiently collected and recorded, cannot by themselves provide logically adequate grounds for predicting the future states of the world. Hence, if science puts forward such predictions and generalizations, then, inspite of its reputation as a classic example of logical thinking it virtually claims more than what it is logically entitled to claim. One would be compelled to say that science is as much hinged on faith as does religion, and is much less honest and clear-sighted about the need to do so.

Popper is right in saying that, in their attitude towards induction, Hume and the several generations of his supporters were governed, decisively, by the outstanding success of Newtonian physics. It was, indeed, very difficult for them to forget the dazzling success of physics in yielding highly generalized and established truths. But, curiously enough, the truth was that these precise and unrestricted generalizations were themselves flimsically based on no wider foundation than a handful of observations made in one very small region of space and time. Nonetheless, induction did work and worked astonishingly well. The crucial question to be answered was : What made it work, what relation was there between the world and the mind of the observer that accounted for its success?

We can, of course, on the lines of the Humen sceptic, admit, or even revel in the claim, that there is no sound logical answer. We may give a psychological justification for our confidence in inductive generalizations, and we may accept that without such confidence not only science but everyday life would be practically impossible. But then this is all that can be done. No doubt such scepticism can be acclaimed for its honesty in refusing to fabricate explanations where none can be found. But, on the other hand, this candidness seems quite unjustified if we keep on making practical use of inductive reasoning even after undermining its logical foundations. However, if at all, we admit this obligation of ours to revise our view of the world, what forms or form should that revision take? It seems that any revision should supplement or reject the atomism embodied in the first of Hume's principles quoted above, *i.e.*, the idea of a world made up of 'objects' which are logically independent of each other, so that there is no valid

inference from the existence of any one such object to the existence of similar numerous objects, and that we are virtually marooned on the one present at any given moment, and that it is only irrational faith or habit which assures us of the existence of any other or others. We might seek solutions to this deadlock : first, we might simply supplement such atomism by an appeal to theology, *i.e.*, to the idea of an intelligent and benevolent Deity who imposes order upon otherwise disparate elements. This solution, was, in principle, adopted by Berkeley, a generation before Hume. Indeed, the general idea of using theology to underwrite natural science has a long history. The second answer was given by Kant. Known as the Copernican Revolution, the answer asserted that the principle of order resides within the mind of the observer. Mind which is rational, imposes certain kinds of order on all its contents of experience, with the result that the world as experienced (though not as it is in itself) must invariably exhibit such order, simply because we cannot see it otherwise. Or the third answer has been given by the various 'dialectical' philosophies of nature, which see the world and its elements as imbued by some internal principle of order. One of its variant is Whiteheads 'philosophy of organism in which the present situation is seen as something *necessarily* linked to a past and a future, thereby furnishing enough grounds for us to expect continuity (or continuous development of characteristics from past to future).

There are thus various doctrines, sound and coherent in their own way, which appear to explain in principle, the successes of induction. They, in fact, provide the major premises required to make inductive reasoning logically respectable, for example, the argument from the assumed divinity of nature.

The Humean sceptic is, however, ready with a volley of counter- arguments. Firstly, he rejects the theistic argument quoted above, on the ground that we hardly want every pattern or regularity to be repeated.

Or even if we are willing to adopt the whole Kantian apparatus of forms and categories—and accept the limitations of the application to the world of phenomenon, with the resultant difficulties over how we can have a shared world or a shared science, or indeed any kind of inter-subject communication whatsoever—would it perform the task for which it was designed? For example, even granted we cannot but think of the phenomenon presented to us as causes and effects, this in itself

could not suffice to account for our success in formulating general causal laws. These would require also that the data provided by experience—or some of them at any rate—must fall into classes sufficiently clearly distinguished, and into patterns sufficiently simple and stable, for our recognition. And it is quite conceivable that it should not be so. Hence Kant's system still leaves us, in this respect, at the mercy of experience. (Incidentally, it is not even true to say that if the world of our experience were too complex or too rapidly changing for science as we know it human survival would not be possible either. Most of the regularities and patterns which science has brought to light have after all been just within the grasp of the most gifted human beings, living in environments favourable for research; the rest of the human species, and all other living species, have demonstrated the possibility of surviving indefinitely in a world they are incapable of understanding scientifically.) With regard to the concepts of a world developing dialectically, with the momentum provided by a succession of internal conflicts and their resolution, or of a Whiteheadean world where each phase is essentially a process of self-creation from the material furnished by the past and provides in its turn material for the self creation of the next generation. This leaves us with fundamentally the same problem; *i.e.*, how do these postulated general patterns actually account for the kind of specific patterns which are the concern of sciences to explore? Is it not a condition of their unrestricted generality that they should be so flexible and loosely defined so as to be consistent with virtually any world imaginable?

Further, even if it is assumed that one or more of the methods, if true, would provide the necessary guarantee, the difficulty lies in showing how any of them could be true. As the Humean sceptic says, we have very limited choice of methods. If all these grandiose answers concerning God, nature and man are based on sense-experience, the problem of their logical inadequacy to support inductive generalizations again crops up. Any such justification of induction is inevitably circular or alternatively, if our methods are going to explain or analyse only our own concepts, how are we going to know what the world is actually like? Other principles may also be said to have been grasped by some intuitive insight (Descarte's 'clear and distinct apprehension') or as Kant says, acceptance of them is inherent in the very nature of the rational mind (Kant's conception of the synthetic a priori).

But then, clearly from the premise, 'We cannot help believing S (even where 'we' comprises the whole of humanity)', nothing follows *ipso facto* about whether or not S is in fact true; and, in any case, how is the premise itself supposed to be an established truth?

Again, of course, the sceptic need not be allowed the last word. It can be objected that the manner in which he has admitted only two ways of establishing truth is arbitrary and unproven and, more specifically, his case for treating pure mathematics (long regarded as an embodiment of general truths not empirically established) as consisting essentially of analytic truths has never been fully made out, and that there are powerful theoretical reasons for thinking that it could not be so. Also the endeavour of, on the one hand, grounding or basing statements on sense-experience, and, on the other, arriving at them by analysis of concepts, has never, it may be said, been rigorously defined. Terms like 'grounded' or 'based' are merely metaphorical and it is difficult to ascertain which of the indefinitely various relationships between our statements and our experience they cover and which they exclude. or, while the term 'analysis' suggests rigour in mathematics and science, the term 'conceptual analysis' in practice means nothing more than giving an ear for what is or is not said, on an Austinian patience[1] and sensitivity with the nuances and variations of linguistic usage, than on any clearly defined rules of procedure. And in the face of demands for explanations and justifications, we can always remind ourselves of the general point that any explanation or justification must perforce appeal to something accepted without explanation or justification to some self-evident truth. To object to any such acceptance only shows our failure to understand the nature of our demand. So in the case of induction, what are we permitted to accept which is self-evidently true or right, and which does not covertly assume the validity of inductive argument?

Such, very roughly, have been some of the lines along which the issue of induction has been discussed since the time of Hume. Popper points out that a dubious issue like induction has been taken for granted in all our sciences. It was presumed beyond doubt that in the leap from particular observations to (purported) general truths consisted the essential method of all our natural sciences—and also indeed of all the unsystematic accumulation of

1. Reference here is made to Austin's book on linguistic philosophy, Popper rejects the very idea of Austinian linguistics.

lore, by the help of which we humans as well as all living creatures, that rise above the level of instinct, find their way about in the world. This is understandable. Granted that man is doomed to live in a world which is not of his making, and which is not obliged in any way to confirm to his own conditions, what *can* he do other than look about him, and make the most of what little he can observe? It is on the basis of his experience that he strives to carve out a niche for himself in the alien world. Popper, in effect, accepts this view of the human situation. What he rejects is, firstly, the traditional view of the role of the inductive method and of the concept of truth in our dealings with the world, and secondly, the view of science as distinct from other human activity by its systematic and rigorous use of the inductive method. Popper says that Hume is substantially right in holding that induction involves a logically invalid argument from some to all—and even the most ingenious efforts could not absolve it from the charge. But then Popper's real contribution lies in pointing out that, contrary to widespread notions, neither our science nor our everyday lore is *actually* based upon induction. Thus induction is no great challenge. The real challenge before epistemology and philosophy of science is to determine how knowledge in general and science in particular develop and what their scope and limits are.

Induction a myth : Popper's psychological argument.

First of all, let us see what Popper's arguments are for claiming that induction is a myth, and that we do not actually rely on it either in science or in our everyday affairs. This, of course, is a different issue from the one concerning the logical validity of induction. Popper's ideas, expressed in several forms and contexts from the opening sections of the Logic of Scientific Discovery and onwards, receive their most emphatic and forceful statement in a lecture delivered by him in 1953 : "Induction, *i.e.*, inference based on many observations, is a myth. It is neither a psychological fact, nor a fact of ordinary life, nor one of scientific procedure".[1]

Popper acknowledges a little earlier in the lecture that the myth is so deep-rooted and persuasive that his attempts to expose it as such, have rarely been taken seriously. He describes his initial frustration when he first tried to do so to a English audience, at a

1. Popper : Conjectures and Refutations : The Growth of Scientific Knowledge p. 53
   Popper : The Logic of Scientific Discovery, p. 40.

meeting of the Aristotelian Society in 1936, when Russell had argued that (unsupported) principle of induction simply had to be adopted as a 'limit of empiricism.' In Popper's view this was, in essence, a Kantian response to Hume's critique, so : "I said first that I did not believe in induction at all, even though I believed in learning from experience, and in an empiricism without those Kantian limits which Russell proposed. This statement, which I formulated as briefly and as pointedly as I could with the halting English at my disposal, was well received by the audience who, it appears, took it as a joke, and laughed."[1]

And, later, at the beginning of his Objective Knowledge we find him complaining of very similar reactions from a new generation of thinkers who had still failed to see the significance of his work.

These reactions are hardly surprising. Granted that experience is the only means of knowing the world, how can we dispense with induction, for it is nothing but systematising of experience for the sake of knowledge. What does this systematising involve? Given that we have only our experience at our disposal and that this experience is bound to be particularistic in its extent; it cannot be anything else but the experience of particular things in particular situations. If this may the case be, men have no other choice but to project their experiences on the world and assume an understanding of the latter in the light of the former. Given the predicament of man, it, however, comes natural to them to derive the unknown from the known, the general from the particular. Hence those dubious leaps from 'All observed *X*'s are *Y*'s to 'All *X*'s are *Y*'s are inevitable. Popper questions this somewhat compelling illogicalness immanent in the foundations of our knowledge of the world. He says that the compulsion is only a presumed one. Moreover, it is a gross confusion, however plausible it may appear at first sight; for it gets the stages of knowledge acquisition in the wrong order, *i.e.* it proposes that first come observations, understood as mere registering of stimuli, by a mind still innocent of all 'maps', expectations, theories etc. and then, from a sufficient base of such observational date, a venture into generalization. But such pure observation, made with a totally innocent eye as it were, is not only psychologically but logically impossible and is at variance with the very nature of observation. By exposing the real process of knowledge acquisition, Popper also

1. The Philosophy of Karl Popper, ed. P.A. Schilpp, Vol. 1. p. 29 ff).

renders Hume's psychological concession to induction as unnecessary. Hume was, perhaps, not able to see that the so-called leap from experience to generality is not so in reality. It is rather one from unproved conjectures to certain proven ones. Although Hume was trying to criticize induction but it can be said that he could not grasp the essential nature of experience. Kant came closer to the problem when he ventured to analyse the structure of experience but emerged with an incomplete answer. He said that the mind imposes its own rational structure on experience. Popper, in a way, extends Kant's answer by saying that the mind imposes not only its laws but also some of its theories and expectations upon its experiences. In fact, Kant, supplemented by Popper, completes the picture of the experienting mind. The two of them together, expose the myth of the paramountcy of experience as upheld by induction, and curiously enough, by its greatest critic, Hume.

"The belief that we can start with pure observations alone, without anything in the nature of theory, is absurd.....Observation is always selective. It needs a chosen object, a definite task, an interest, a point of view, a problem. And its description presupposes a descriptive language, with property words; it presupposes similarity and classification, which in its turn, presupposes interests, points of view, and problems.....For an animal, a point of view is provided by its needs, the task of the moment, and its expectations; for a scientist by his theoretical interests, the special problem under investigation, his conjectures and anticipations, and the theories which he accepts as a kind of background."[1]

To illustrate his point, Popper reminds us of the man who devoted his life to 'observing' (*i.e.*, anything and everything that came under his notice) and then bequeathed his vast collection of findings to the Royal Society, in the vain hope that they had value as 'inductive evidence'. He also records how he once told a class of students to observe carefully and write down on a paper what they had observed, to bring home to them the point that until they were told what to observe, he instruction simply could not be obeyed. Actually, Popper says this in the Pickwickian sense that one cannot observe each and everything in society. In a later work, he quotes from Darwin 'How odd it is that anyone should not see

1. Popper : Conjectures and Refutation's : The Growtn of Scientific Knowledge, p. 46.

that all observation must be for or against some view'[1] and goes on to elaborate : 'Neither 'observe' (without indication of what) nor 'observe this spider' is a clear imperative. But 'observe whether this spider climbs up, or down, as I expect it will' would be clear enough.'[2] These conjectures, expectations, preceding observations are not chosen by the mind at random, says Popper, for they in turn may be variously conditioned by earlier observations, rather have been developed to account for what was puzzling or unexpected in those observations.

"There is no danger here of an infinite regress. Going back to more and more primitive theories and myths we shall in the end find unconscious, inborn expectations. The theory of inborn ideas is absurd, I think; but every organism has inborn reactions or responses; and among them, responses adapted to impending events. These responses we may describe as 'expectations' without implying that these 'expectations' are conscious. The new-born baby 'expects', in this sense, to be fed (and, one could even argue, to be protected and loved)"[3]

In the above context, Popper quite reasonably, speaks of 'inborn knowledge'. The inverted commas suggest Popper's insistence that any such knowledge, even if shared by the whole of humanity, doesn't carry any immunity against falsifiability.

Early empiricism, then, it cannot be denied, was faulty in its premise that the percipient mind was a passive receiver, an empty cabinet, a bucket, or a tabula rasa as Locke conceived it. It was Kant, who, for the first time, got a feel of reality when he asserted that the mind was essentially active, operating on each and every subject matter presented to it. His only error lay in supposing that it could *impose* order on them, instead of merely seeking it. In the development of our science and our every day lore about the world, there is no place for the passive reception of Humean 'impressions' or the cumulative effects of their repetitions in producing expectations or general beliefs. To maintain that the existence or the strength of expectations is the result of their repetitions is not only faulty, says Popper, but illogical as well. There is no absolute sense in which a set of experiences are

1. Francis Darwin (ed.), More Letters of Charles Darwin, Vol. 1, 1903, p. 195.
2. Popper : Objective Knowledge : An Evolutionary Approach, p. 259.
3. Popper : Conjectures and Refutations : The Growth of Scientific Knowledge, p. 47.

repetitions of some prototypical experiences. They are.....result of repetition.[1]

In other words, whether we see two things to be the same or different, depends on the respects in which we compare them. Quite generally, our judgments of sameness and differences are determined, in essential part, by the range of concepts, of possible points of comparison, available to us, and then by deciding as to which of these we are interested in applying in a particular case—and also in some cases by the degree of rigour with which we apply them. The judgments are not made for us, or imposed on us, by what is simply given to us in experience; they are made as a result of looking for, or expecting, or wondering about the possibility of, some common feature.

The point, following from what has gone above, is not that we should not adopt induction because it sins against logic—but that we cannot, even if we wanted to, because it is a hypothetical concept which is quite at variance with the functioning of human mind and is, therefore, of no use to us. Induction, as is conventionally understood, is a process of receiving with an open and inactive mind, various impressions of experience, and registering some patterns as emerging out of these impressions, and expecting on this basis their recurrence in future as well. The fallacy of induction lies in our perception; it is not that some pattern is inherent in our sense data which is churned out of various repetitions, as butter is churned out of buttermilk. The sense-data is mum in itself. *It is our own selection or point of view* that enables us to see a particular pattern in our sense-experience. Why we consider induction as taken for granted is because our own activities of selection and decision are so common and all pervasive that they can readily be over looked. According to Popper, we start our conscious lives with certain primitive interests and expectations, and enlarge and develop these in response to their fulfillments or disappointments. It is difficult, indeed, once this point is made, to view all our experiences in an utterly disinterested spirit to which no one element of them was more important then the other.

However, experience may not be the best teacher for Popper, it is still the sole arbiter. Among our numerous expectations, we

1. Popper : Conjectures and Refutations : The Growth of Scientific Knowledge, p. 47f. And Popper : The Logic of Scientific Discovery, p. 420ff.

are made to nurture or modify some, while change or abandon others in the course of our experiences of life. Many of our theories or hypotheses appear untenable in the light of our experiences of the world. Howsoever, important our own activities of selection or decision may be, we can only select from, or decide whether, or how to use, the raw materials which experience furnishes; the things, the qualities and the relationships which we actually find. Experience still has the last word. And Popper in fact sees our whole intellectual development as an unending process of adjustment and modification of these interests, expectations and theories under the pressure of experience.

The growth of our knowledge is the result of a process closely resembling what Darwin called 'natural selection'; that is, the natural selection of hypotheses. One knowledge consists, at every moment, of those hypotheses which have shown their (comparative) fitness by surviving so far in their struggle for existence; a competitive struggle eliminating hypotheses which are unfit. However, this interpretation is broad enough and may be applied to animal knowledge, pre-scientific knowledge, and to scientific knowledge. Nevertheless, what is peculiar to scientific knowledge is this : the struggle for existence is made harder by the conscious and systematic criticism of our theories. Thus, while animal knowledge and pre-scientific knowledge grow mainly through the elimination of those holding the unfit hypotheses, scientific criticism often makes our theories perish eliminating our mistaken beliefs before such beliefs lead to our own elimination.[1]

Thus at the pre-scientific state, we hold and act on many 'hypotheses', some of them may not be more than rules of thumb, some vaguely formulated, others not formulated at all. But the common point among all of them is that we do not systematically seek out circumstances to examine them. We are content to wait until they arrive. But when we systematically undertake such testing, *i.e.*, by deliberately challenging the world to try to eliminate our hypotheses, and giving it every opportunity to do so by formulating the hypotheses and working out their implications as precisely as possible, and then looking for or constructing the relevant experience situations—then we have passed to the stage of science. This stage, as Popper points out, has the biological advantage of making our hypotheses suffer by eliminating the unfit or the erroneous ones under laboratory conditions rather than

1. Popper : Objective Knowledge : An Evolutionary Approach p. 201.

having our lives depend on them.

Popper's Hypothetico-Deductive (Non-Inductive) Model of Science.

If Popper is right and there is no such thing as 'induction' then the character of natural science has been long and widely misunderstood. It had been commonly held that it was the systematic use of induction which distinguished natural sciences from mathematics and metaphysics. With Popper, the need arises that a radically new version of natural sciences, one without induction, should be found out.

In order to give such an account, Popper had to do away with a more basic and worthwhile presumption of induction—the concept of truth. It is this goal which had all through sensitized traditional science and had provided the logic for an endless search of verifiable, true observations. In order to build a non-inductive, rather deductive science, Popper, as an initial step, denies stressfully that the response to the world, is not, simply and without qualification, truth. He is fully justified in saying that an overriding desire for truth sacrifices the quality of the content of scientific statements; they become either too vague or too cautious and in both the cases they lose their interest, their theoretical and practical importance. They become platitudes which aren't of much use to us. Worthwhile statements are the ones which are not only true but important as well. And such statements tend to be highly exact and complex in content. The price to be paid for dealing in such statements is that only in exceptional and fortunate circumstances are they likely to be true; usually they allow too many ways in which the world may fail to conform to them, or they to the world. They are not of course made at random.

Thus, in important areas of research at least, it is futile to set ourselves to discover the Truth, or even to try to show that a given theory is true. It is futile—logically as well as historically. Logically, there always remains the possibility of at least one white crow (to refute the generalization that all crows are black) and historically, there is evidence that any serious hypothesis, purporting to set out exactly the workings of some part of nature, even if it covers all the data currently available, is unlikely to be more than an approximation to the truth, or to embody some part of it. Thus the task of research is not to seek evidence in favour of the hypothesis; for we could increase the volume of favourable evidence *ad*

infinitum simply by repeating the experiments which suggested it in the first place. It is much more valuable to get straight to the point where it breaks down, and hence is in need of modification, and for this purpose, to devise the most exacting tests, the ones it is least likely to pass. The denial of the role traditionally ascribed to induction amounts then to this : What is essential to the development of science (and of our everyday knowledge of the world as well) is the discovery, not of *many* observational data which support a given hypothesis, but of *one* which refutes it.

Once Hume and his successors have pointed out how few kinds of statement can be verified in any strict sense, we should think twice before considering verification as the primary aim of science. We can preserve its 'verification' function by allowing it to say less and less—by confining it, like Kant, to the world of phenomenon, or like Schlick and other positivists, denying it the capacity to make general statements, and reducing its supposed general laws to prescriptions or instruments for prediction.[1]

By contrast Popper sees it as primarily concerned with falsifying statements, rather than with verifying them. The reasons, once again, are quite simple but sound. If we encounter the world with certain expectation's, certain theories, our first responsibility lies in rectifying them as they are the real bridges to connect us to the outside world. And the most effective role that science (or any serious enquiry) can perform is that of an iconoclast, bringing to our attention as quickly and effectively as possible the limitations of this equipment and the ways in which it can be improved, and improvement obviously means error elimination rather than preservation of defects as and where they, are.

The demarcation-line between statements belonging to science on the one hand and metaphysics or theology on the other is the former's falsifiability. It cannot be said that while metaphysical or theological statements cannot be shown to be true or probable, the theory of gravitation can, though Hume has shown once for all that logically at cannot.

> "I shall certainly admit a system as empirical or scientific only if it is capable of being tested by experience.....not the verifiability but the falsifiability of a system is to be taken as a criterion of demarcation.....it must be possible for an empirical scientific system to be refuted by

1. Popper : The Logic of Scientific Discovery, p. 37 and n.

experience."[1]

His conclusion about science : "Every "good" scientific theory is a prohibition : it forbids certain things to happen. The more a theory forbids, the better it is.....A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.....the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability."[2]

The most immediate advantage, however, of substituting falsifiability for verifiability as part at least of our criterion of science lies in the asymmetry between verification and falsifiability; an asymmetry which results from the logical form of universal statements. For these are never derivable from singular statement, but can be contradicted by singular statements. Consequently it is possible by means of purely deductive inferences.....to argue from the truth of singular statements to the falsity of universal statements.[3]

Science thus becomes logically respectable, and Hume's famous critique ceases to be relevant. What is claimed as 'scientific knowledge' depends on that point in history at which the claim is made. It is that body of theories which have thus far survived systematic testing; and the progress of such testing, and the modifications of theory made in response to it mean that our scientific knowledge is in constant process of self-change and self-renewal. Even those theories which no scientist is at the moment seeking to refute and which are treated, and taught, in departments of science as though they were established truths, can still, logically lay claim to no title stronger than that of conjectures—conjectures, it may be, that are very well corroborated, in the sense of having survived many tests[4] but conjectures none the less, which future research may well find reason to replace.

A genuinely scientific theory then, lives dangerously. It puts itself at risk by ruling something out, forbidding something to happen. And the more it forbids the better it is; if, for example, it rules out everything but one quite specific, and *prima facie* unlikely outcome in a specific set of circumstances, and gets away with it,

1. Popper : The Logic of Scientific Discovery. p. 40.
2. Popper : Conjectures and Refutations, p. 36 p.
3. Popper : The Logic of Scientific Discovery, p. 41.
4. The Logic of Scientific Discovery,p. 251 ff.

this is a genuine scientific triumph. This was for Popper the supreme merit of Einstein's theory over those of the other intellectual heroes of his student years, Marx, Frend and Adler. It was not that he thought Einstein had established the truth of his theory, while the others had failed. What he disapproved about Marxism and the ideas of the psychologists was precisely what many of his contemporaries seemed to find most admirable about them : their apparently limitless explanatory power.

These theories appeared to be able to explain practically everything that happened within the fields to which they referred. The study of them seemed to have the effect of an intellectual conversion or revelation, opening your eyes to a new truth hidden from those not yet initiated. Once your eyes were thus opened you saw confirming instances everywhere : the world was full of verifications of the theory. Whatever happened always confirmed it.[1]

When Einstein, on the other hand, used his novel gravitational theory to predict what would be observed during an eclipse of the sun, by no means everything that could happen would confirm it. Indeed every finding other than precisely the one predicted would refute it. And for Popper,

"The impressive thing about this case is the risk involved in a prediction of this kind. If observation showed that the predicted effect is definitely absent, then the theory is simply refuted. The theory is incompatible with certain possible results of observation.....in fact with results which everybody before Einstein would have expected"[2]

It was this last fact that made the fulfilment of Einstein's prediction a major landmark in the history of science, for it was at the same time the falsification of a body that, until then, had commanded almost universal assent. But the crucial point here is simply that, while getting away with such a risk did not make Einstein necessarily right—there are always further tests to be faced—taking such a risk made him a genuine scientist.

The tension-points in Popper's model.

We now have an attractively simple formula as to what constitutes genuine research or a real contribution to science. It is, in effect, a confrontation between imaginative theory and observed

1. Popper : Conjectures and Refutations, p. 34 f.
2. Popper : Conjectures and Refutations, p. 36.

fact. The theory is essential but the observation must be allowed the last word, otherwise it is not science.

It is tempting to turn this account of science against itself by ways of corroborating its rival theory namely, that the primary purpose of science is to establish general truths by the systematic use of observation. And certainly the main purpose of Popper's philosophy of science has been to turn attention away from the pseudo-problems of induction and to stimulate a notable variety of attempts to diagnose and correct the over- simplifications of his own. In fairness to Popper, however, it must be admitted that like philosophy, science also consists of a whole range of activities, a range with ill-defined and disputed boundaries and with complex and varied relations between its elements. And just as we cannot find an essence of philosophy, we cannot get one of science either, which can be summed-up in a neat formula. And all that Popper actually claims to do, by way of putting forward his criterion for the demarcation of science, is to make a proposal for an agreement or convention.[1]

But then such an agreement or convention is not intended to be an arbitrary one. Any criterion for the demarcation of science is meant not only to distinguish between two important variants of human discourse—falsifiable and non-falsifiable statements, but to bring ordinary scientific discourse into the fold of genuine (falsifiable) science.

Popper has been extensively criticised for these ideas. Only the most salient criticisms will be discussed here.

To begin with, there would seem to be important findings about the world which could not be falsified by any observations, but which we should certainly want to classify as science rather than as metaphysics or anything else. Thus William Kneale argues that Popper's criterion of demarcation commits him :

> "To the paradoxical thesis that all unrestricted existential proposition's are metaphysical and non-empirical.
>
> But.....
>
> suppose that on some occasion when I have been rashly dogmatic about the behaviour of fish out of water a biologist reminds me, in an unrestricted existential statement, that there are, after all, lung fish which can breathe on dry land. I do not dismiss his remark as irrelevant metaphysics, but

1. Popper : The Logic of Scientific Discovery p. 27.

humbly accept it as good empirical information.

And again,

> the discovery of the positron, which we express.....by means of an unrestricted existential statement in the present tense, can properly be said to belong where most people think it does, namely to science, rather than to metaphysics or history.[1]

An 'unrestricted existential statement' is one which asserts, without restriction to any region of space or time, the existence of something, (plants planet, particle or whatever) with certain specific properties; and obviously while such a statement, in contrast to our unrestricted generalization's can sometimes be verified by observation's it can never be falsified by them. But, as the positron example illustrates, such statements can play an important role in science. Scientific research is concerned to discover the wealth and variety of the furnishings of the world, as well as the laws governing the arrangement and interaction of its elements. For example, Kneale points out that biology, geology or astronomy are replete with such unrestricted existential statements. Although Popper does not comment on this yet, it should be conceded that there are some characteristic elements of scientific discourse which do not satisfy Popper's criterion, because they are not strictly speaking, falsifiable. However, there may be yet another possibility that some unrestricted existential statement couldn't ever be falsified, in which case they can very well be eliminated from science. This concept of elimination, as something wider than falsification, has no doubt a use in explaining some elements of the progress of science. But eliminability could not replace falsifiability as a more accommodating criterion of science, since it is a feature of metaphysics as well and indeed of any disciplined study whatsoever. It is in effect simply the application of Occam's, razor; whenever we do not need a hypothesis, in any field, we discard it. So far as falsifiability is concerned, there are some falsifiable statement (for example the trivialities and ephemera of everyday discourse) which are not science, and some unfalsifiable statements (our unrestricted existential statements) which are.

Confrontation Between theory and observation.

To come back o Popper's assumption that in the testing of

1. The Philosophy of Karl Popper. p. 206 ff.

theories, it is observation that has the last word, the question arises : on what grounds do we accept the final authority of observation? Isn't our faith inductive in its foundations? for unless we think that the observations we have made are repeatable, and they continue to yield the same result in the future as they have in the past, we will not take the tests seriously, nor shall we accept or have future confidence in a theory on the basis of past or present tests. Our faith in tests, in their results and ultimately acceptance or rejection of a theory on their basis is not only empirical but inductive. The same test always yields the same result is not an inductive generalization but an analytic truth, yet the faith that the future, will resemble the past is nothing else except induction. It is these tests which have a crucial (negative) role to play in the Popperian conception of science; but if their efficacy is inductive in nature, how can this fact be reconciled with Popper's hypothetico-deductive model of scientific research and the thorough-going rejection of induction immanent in it?

So much for this contradiction in Popper. And independent of it, the fact remains that test situation's will recur and the record of how our various theories fared in them in the past is a guide to how they will fare in the future—otherwise our science would have merely historical interest. And science has always made stronger claims for itself than that. And the basis of these claims is obviously the inductive method of science. Curiously enough, Popper too, in an earlier discussion of induction says something in the same vien.

"Admittedly, it is perfectly reasonable to act on the assumption that it [*i.e.* the future] will, in many respects, be like the past, and that well-tested laws will continue to hold;.....but.....One might even say to judge from past experience, and from our general scientific knowledge, the future will *not* be like the past in perhaps most of the ways which those have in mind who say it will. Water will sometimes not quench thirst, and air will choke those who breathe it."[1]

Here, inspite of his admittance of induction as 'perfectly reasonable', he also admonishes us to judge from past experience and reasonably, use this experience as a ground for looking forward to a certain measure of continuity, punctuated, no doubt with novelties and surprises, extending into future. Hume's argument that it cannot be a logically sufficient ground still holds,

1. Popper : Conjectures and Refutations, p. 56.

of course. But Popper does not seem able to show that science (and our everyday lore about the world) can avoid reliance on it, and still perform the functions they do in human life.

That observational results are the final court's from which theories have no appeal requires some fairly radical modifications. It has the merit of bringing out one undeniable fact about science *i.e.*, that the scientist, whatever freedom he might have in the choice of concepts and methods and in the formulation of theories, is still a man under the question. 'But is this how things actually are in the world?', and the answer is not of his own making. But just how this question arises, and how it may be dealt with, are not themselves question's which admit of simple answers.

Let's imagine what happens when observational results actually confront scientific theories. As the practice goes there are many alternative moves other than simply dropping the theory which is a rarest of possibility. An unassuming student may be asked to go on improving upon his experiments till he gets conformatory results, a scientist may cling blindly to his pet theory ignoring unfavourable results even from reputable and independent researchers as conspiracies to discredit him. And between these extremes, there is often in many fields of research, an area of doubt and disagreement even among orthodox professional scientists over what should be made of the available experimental evidence and whether it suffices to overthrow a given theory or not.

Apart from this, testing scientific theories is very rarely the simple matter suggested by the 'All crows are black' kind of example, where all that is needed is an alert and honest observer.

Devising tests is often a very round about affair, requiring considerable technical ingenuity as well as familiarity with, and reliance on, a complex of other theories. Moreover, the recording of data has its own inherent and unsurmountable problems. The terms we ordinarily use for the recording commit us for beyond the content of nay finite set of sense-experience. The experimenter as well as the theorist has to live with the permanent possibility of falsification; there is no question of simply contrasting speculative theories with infallible observation-statements. Popper is of course well aware of this. As he points out in the Logic of Scientific Discovery :

> "We can utter no scientific statement that does not go far beyond what can be known with certainty 'on the basis of

immediate experience.' (This fact may be referred to as the 'transcendence inherent in any description'.) Every description uses universal names (or symbols, or ideas); every statement has the character of a theory, of a hypothesis. The statement 'Here is a glass of water' cannot be verified by any observational experience; The reason that the universals which appear in it cannot be correlated with any specific sense- experience."[1]

A few pages later he says :

"I readily admit that only observation can give us 'knowledge concerning facts' and that we can (as Hahn says) become aware of facts only by observation. But this awareness, this knowledge of ours, does not justify or establish the truth of any statement."[2]

Thus, even the simplest of sense-experience, the so-called 'basic statements' by definition those asserting that an observable event is occurring in a certain region of space and time'[3]—are, like any other, within the realm of possible error and controversy.

"Accordingly, we can claim no more than that—Every test of a theory, whether resulting in its corroboration or falsification, must stop at some basic statement or other which we decide to accept.....the decision to accept a basic statement, and to be satisfied with it, is causally connected with our experiences—especially with our perceptual experiences. But we do not attempt to justify basic statements by these experiences. Experiences can *motivate a decision*, and hence an acceptance or a rejection of a statement; but a basic statement cannot be justified by them—no more than by thumping the table. Basic statements are accepted as the result of a decision or agreement; and to that extent they are conventions."[4]

Such decisions, etc. are not of course merely arbitrary. There are, in most cases at least precisely formulated and widely accepted rules for making the required observation's, and various checks and supplementary tests to fall back on, in cases of dispute. However, consensus among the relevant group of researchers as to

1. Popper : The Logic of Scientific Discovery, p. 94 f.
2. Popper : The Logic of Scientific Discovery, p. 98.
3. Popper : The Logic of Scientific Discovery, p. 103.
4. Popper : The Logic of Scientific Discovery, p. 104 ff.

which basic statement should be accepted, is normally easy enough to achieve. It can rather be imposed by labelling as crank and excluding from the relevant group anyone who fails to agree. The revelation that every so-called basic- statement contains many non-basic universal concepts, renders the statements hardly basic and, therefore, no more authoritative. Another fact remains that our basic statements are inherently fallible for the same reason as our generalizations are, because here again we find the unbridgeable logical gap between the conventionally appropriate criterion *for* making them and commitments we undertake *in* making them.

If this is the case, the consequences for Popper's whole theory are extremely serious. The 'refutation' of any proposed theory can only be put in a hypothetical form 'if certain basic statements are accepted.....' etc. But suppose they are not or that different groups of researchers accept different sets of basic statements? It would seem that the best remedy possible is to hope and pray that everyone who matters in the scientific world will agree on the same observations. There can be no final or absolute refutation of any given theory, and hence no absolute scale by which we can measure scientific progress. All that can be said is that certain theories and certain basic statements are mutually inconsistent, not that any of them has been shown conclusively to be true—or even false. Towards the end of the original text of the L.S.D., Popper himself makes this point.

"In the logic of science here outlined it is possible to avoid using the concepts 'true' and 'false'. Their place may be taken by logical considerations about derivability relations.....we need not say that the theory is 'false', but we may say instead that it is contradicted by a certain set of accepted basic statements. Nor need we say of basic statements that they are 'true' or 'false', for we may interpret their acceptance as the result of a conventional decision, and the accepted statements as results of that decision."[1]

This passage reveals an important and unavoidable consequence of Popper's account of basic statements. There is no immovable rock on which to build. And however much he insists on the importance for science of the rigorous and systematic testing of statements, if such tests are never logically sufficient to establish the truth of any statement, then they never entitle us to say "Since the truth of *a*, *b*, and *c* has been established, *x* must be

1. Popper : The Logic of Scientific Discovery, page 273.

rejected as false.'—but only 'if we accept *a*, *b* and *c* as true, then we must reject *x* as false'. No theory can then be conclusively falsified any more than it can be conclusively verified; and scientific progress, in any absolute sense, is an illusion only for those who are naive enough to overlook the role of convention in the establishment of our basic statements.

If such an appeal to conventions is indeed unavoidable, why should we have inhibitions in accepting induction which, no matter how illogical, is also based on convention. There is no obvious reason why the convention required for their 'verification' should be any more offensive than the conventions which, as we have just seen, are required for their 'falsification', Popper may not mind giving this license because as he says—ultimately all scientific statements (whether generalization's or basic statement) can always be tested further. But then if the results of this testing are also going to be accepted as a matter of decision, then we are still in the realm of decision rather than where Popper emphatically claims science ought to operate; *i.e.* in the realm of discovery.

It will be clear later on that Popper seriously underestimates the strength of the relativism that threatens. Indeed, this is the main criticism against Popper that he fails to appreciate the force of the arguments in favour of relativism inspite of their being present in his own commendably honest and perceptive remarks, just quoted, about the inherent vulnerability of basic statements.

Popper's Propensity Theory : His criticism of the Probability Theory.

Being an indeterminist Popper supports the probability theory but suggests a significant modification in it by the name of propensity theory. This theory has many implications : Popper supports the quantum theory, criticizes Kant's deterministic ethics and develops his own characteristic evolutionary epistemology—all because of this theory.

Popper supports the quantum theory but, surprisingly, criticizes the probability theory which is just its complementary. It is his view that the probability theory, although ostensibly a theory of scientific indeterminism, tacitly assumes metaphysical determinism. Here too, Watkins becomes relevant for he says that many philosophers have combined metaphysical determinism with scientific indeterminism. Popper views probability theory as the

vestige of metaphysical determinism. He interprets it to have presupposed a perfectly designed universe but at the same time tacitly acknowledges ignorance of that design on the knower's part and thus adopts the probabilistic attitude as a sign of that limited knowledge. Popper also points out that another major weakness of the theory is that it allows intrusion of a knower, a subject. This subjectivism, says he, is against the essence of science and of epistemology in general. Popper's noteworthy contribution lies in replacing the probability theory by a propensity theory. This latter theory has the merit of retaining the scientific indeterminism of the probability theory while eliminating its demerits of metaphysical determinism and epistemological subjectivism. Popper, admits that the statistical theory, a child of the probability theory, has the merit of being indeterminist, but since the parent theory preserved its subjective stand, the whole concept of probability became one of oscillation between objectivism and subjectivism. Popper's solution, however, puts an end to this vascillation.

Probability, as a concept, presumes limitation of our knowledge, the knower's knowledge, Popper says. But propensity is an attribute of the experimental situation which is independent of the knowing subject. Further, it is the propending nature of objective reality which invokes a probabilistic attitude in the knower's mind. Probability, then becomes a subjective element. Yet probability need not be eliminated, it can be treated as a conjecture which is inter-subjectively testable, says Popper. He, thus, does not negate subjectivity, rather relegates it to the background by stressing its objective testability.

If propensity is the inherent quality of the physical phenomenon and not a limitation on the part of the knowers, metaphysical determinism is undermined. It is replaced by metaphysical indeterminism. Popper may be acclaimed for making science and its metaphysics—metascience if it may be called, as mutually consistent. He combines metaphysical indeterminism with scientific indeterminism by explaining the physical phenomenon with the theory of propensity. Popper, on the one hand, makes science and metaphysics complementary, and on the other, makes the nature of science objective *i.e*, intersubjectively testable. This objective science, then comes in tune with his general objective epistemology. Knowledge for Popper, is an endeavour in which the knowing medium is not important. It is the objective quality of that knowledge which is important. And objectivity

consists in its rationality. Knowledge is important if it can be rationally discussed, criticised, corrected and inter-subjectively testable so far as science is concerned. Regarding this objectivity and refutability of knowledge, and of science, much shall be said later.

Criticism of Kant

Being an indeterminist, Popper criticises Kant's deterministic ethics on logical and empirical grounds. By determinism Kant means that the human world is as precisely governed by laws as the physical world is but since we cannot know all those laws, predictions are not as possible as they are in physical world. Popper says that the logical flaw in this theory is that it is neither demonstrable nor refutable. The empirical flaw is that it is virtually impossible to know all the regularities governing human world.

Popper's Evolutionary Epistemology.

And lastly a few words on Popper's evolutionary epistemology. It flows from his metaphysical indeterminism, as mentioned earlier. The term has a double meaning for Popper. Firstly, it means that the nature of knowledge and of science is progressive—its' a movement towards increasingly better theories. Secondly, it means that progress in science (also in knowledge in general) can be understood as selection of the best theory from amongst several competing theories. Selection is made in the Darwinian sense. The most well-adapted theory is selected in science, one that explains a particular problem in the most precise manner. Popper also uses the concept of Darwinian evolutionism to equate the growth of knowledge with the growth of organic life on earth. Evolution occurs by way of mutation resulting from the efforts of the organism to adopt itself to the environment. Knowledge is also an endeavour of human mind to understand and adjust to the world around by the method of trial and error. The scientific version of knowledge exemplifies this method in a very lucid manner.

Criticism of Popper's Concepts of Truth and Verisimilitude.

Popper terms primary empirical statements as basic statements. For him, basic statements, are 'singular existential statements' which tell that an event of such and such a kind occurred at such and such a place and time. The only condition is

that their presence or absence should be publicly observable. Popper says that these statements cannot be conclusively right or wrong, because direct experience, which is the basis here, is never a reliable guide. It can only 'motivate' us to accept or reject a statement as true or false, but it can never 'justify' us in doing this. Thus ultimately one observational assertion will be a matter of our relatively independent decision. In other words, our observations are right or wrong only in the sense in which 'we decide' to accept or to reject them. This only means that there is no 'objective' truth or falsity about our experiences.

A.J. Ayer says that this assumption on the part of Popper brings him very close to pragmatism.[1] The only difference is that like the pragmatists, he does not identify truth with verification. Truth and falsehood are absolute concepts with Popper; whereas they are relative terms for the pragmatists. For them, verification or corroboration of theories are to be attained in degrees that too at a particular time and place. Popper's similarity with the pragmatists lies in the fact that he too choses to work with the concept of corroboration and acceptance.

In the 'Logic of Scientific Discovery' Popper rejects the concepts of truth and falsehood. He simply says that they are innocent terms and that he doesn't need them. But in Conjectures and Refutations, he accepts Tarski's scheme '*S* is true in *L* if and only if *P*' because it achieves that classical concept of truth as 'correspondence with facts', and further says that he relies on the notion of truth at least as a regulative principle. Popper arrives at this conclusion by sharing Pierce's assumption that fallibility of our beliefs logically implies a standard of truth of which we may fall short. In other words, Pierce means to say that attainability of truth is also a presupposition of scientific inquiry. But in answer to the question whether truth is attainable to in scientific theories, Popper's is an emphatic 'no'. In his essay, Sources of Knowledge and Ignorance, Popper dissents from both the rationalist and the empiricist explanations of truth. In his, Truth Rationality and the Growth of Knowledge, he says that there are no criteria of truth, nevertheless, there are criteria of progress towards the truth.

In his efforts to examine Popper's ideas on truth, Ayer, first of all, attacks his criticism of induction. There is no essential difference between the inductive concept of verification and the

1. A.J. Ayer in the Library of Living Philosophers, Book II, p. 684.

Popperian concept of corroboration,[1] says he, for, the inductive thesis that accumulation of positive instances confirms a universal hypothesis and Popper's own stand that failure of the instances to be negative, corroborates it, are virtually the same. Nevertheless Ayer admits, there is one major difference between the inductive viewpoint and that of Popper's : confirmation (of hypothesis). The inductive method is fruitful because it gives credit to hypothesis; however, credit evades the hypotheses in Popper because he speaks only of their rigorous testing and also denies that any number of tests will establish them as true. This situation is quite paradoxical. In fact Popper's decisive concept is one of falsifiability. Yet non attainment of which does not *ipso facto* salvage the theories. Moreover, to the extent to which a theory is open to tests, it cannot give any guarantee of truth.[2]

I feel that Popper tries to present the rational process through which science specifically and knowledge generally grows. It is true that *prima facie* Popper's ideas on the nature of science and knowledge appear to be quite negative, frustrating, rather cynical, yet cannot but be acclaimed for being realistic and bold.

Popper's assumption that there are no general criterion of recognizing truth is correct, says Ayer, in the sense that there are no infallible means of telling in advance what the result of testing theoretical statements will be. Yet in another sense there does exist a criterion of truth. It is another thing that practically it comes out to mean the criterion of falsifiability in the Popperian system. Popper says that even one counter example proves a statement (or a theory) false but complete absence of any counter example does not prove it because one is never sure of exhausting all the instances. Nevertheless, Ayer dares to say that absence of a counter example is a sufficient ground to establish the truth of a theoretical statement for all practical purposes.[3] Popper, however, does not accept this, he admits that the only way in which a theoretical statement can be falsified, is by bringing it into conflict with a basic statement. The truth and falsity of a theoretical statement is thus decided by the truth and falsity of some set of basic statements. It follows that if a general criterion of the truth of these

1. A.J. Ayer in the Library of Living Philosophers, Book II ed. Paul Schilpp, p. 685 infra.
2. A.J. Ayer in the Library of Living Philosopher p. 686.
3. *Ibid.*, cp. p. 686, ".....a theoretical statement is true.....if and only if there is no counterexample to it.

basic statements can be established, we may rightfully have a general criterion of the truth of theoretical statements. Indeed, the scientific community, at large, presumes that observation furnishes this criterion. Basic statements, in fact, are observable statements. They are the first and the final authority to prove or disprove a theory. But surprisingly, Popper refutes this broad scientific assumption. His stance is : basic statements do not refer to observable events; observation is not a compelling guide to acceptance or rejection of theories, it cannot justify or dictate, only motivate acceptance or rejection of theories. The decision to accept or reject a theory seems to be an arbitrary one in Popper, for he opens the possibility of our rejecting a true basic statement and accepting a false one. Popper argues, "Experience can motivate a decision and hence an acceptance or a rejection of a statement, but a basic statement cannot be justified by them—no more than by thumping the table."[1]

The scene is a very confusing one. Falsifiability of theories is a central concept of scientific methodology for Popper. But it doesn't seem to have a sound basis. The entire concept seems quite implausible. The conviction that experience is the true source of knowledge belongs, according to Popper, to the theory of psychologism in epistemology of which he is a very sever critic. It is this antagonism which explains Popper's refusal to accept experience as a final justification of statements—basic, then, theoretical. However, it is just the opposite of what other philosophers hold. Sense data are the most reliable sources of knowledge—the bedrock on which the edifice of scientific knowledge could be firmly built and improved. Within such a frame of unflinching faith in sense- experience there was no room for the problem of infinite regress. It was logically pre-empted. (However, this is serious problem that plagues Popper's scientific method.) However, Popper rejects the very notion of the reliability of sensory perception. He says that the report of experience *isn't* pure because there is a 'transcendence inherent in any description.'[2]

When no experience is pure, it cannot be a valid basis for any other statement, it goes without saying that all empirical statements, including even the basic ones, stand on a very infirm ground in Popper. The process of infinite regress seems inevitable.

1. Popper : The Logic of Scientific Discovery p. 105.
2. Popper : The Logic of Scientific Discovery p. 94- 95.

However, Popper tries to forestall it simply (though unconvincingly) by *deciding* to accept certain basic statements without anymore tests. The situation is somewhat funny. Popper appeals to the highest court of sense-perception but refuses to accept its verdict. It is ironical to note that a relentless rationalist like Popper should compromise with logic at the very foundation of his system. Does it not remind one of the assumption immanent in Popper that when it comes to the basic moral values that sustain our social philosophies and programmes, we have no other option but to leave logic aside and simply rely on our intuitions, or simply decide to choose one value rather than another? Popper's arbitrary attitude regarding basic statements in science is suggestive of the alogical, supra- rational autonomy of moral values in the social sciences. It confirms that Popper's faith in freedom and openness is absolute and arbitrary, as it should be.

Nevertheless, coming back to Popper's own system, it is hard to understand his rejection of observation on the ground that it transcends experience. Sense-data is the basic desideratum of empiricism. This long epistemological tradition deems sense-experience as self-evident, *i.e.*, hardly needing any further explanation.

Popper's Theory of Rational Knowledge.

Popper's theory of knowledge is actually a theory of rational knowledge, or what Popper labels more appropriately, as the epistemology of critical rationalism. His critical rationalism is, in fact, a judicious blending of both rationalism and irrationalism. By rationalism he means the rationalism of Descartes and by irrationalism, the philosophy of Bergson, Burke and Nietzche.

All knowledge originates in imagination or irrational faith in some theory but intends to control it with detached rational criticism. It is in this sense that Popper acknowledges the role of both reason and unreason in educating man. Hence, Popper frames his theory of knowledge with a realistic blending of rationalism and irrationalism. He accepts both without acquiescing to the radical forms of either of the two.

This blending is not a matter of intellectual choice for Popper. It is realism, a basic trait of his philosophy. Without getting *charmed* or repulsed by any philosophy, he is candid and honest enough to expose the actual constitution of knowledge. And if that constitution does not allow a clear-cut intellectual labelling, Popper

feels himself under no obligation to do so for the sake of tradition. Popper is brilliant yet different from our image of philosophers, for he defies normal classification. He is neither a total rationalist nor a total irrationalist. That is why in the context of the traditional dispute between rationalism and irrationalism, Popper's contribution is a bit original. He in a way explodes the myth that there is a clash between the two. The actual process of knowledge is a blending of the two, with preponderance of rationalism, no doubt. Nevertheless, a slight ambiguity should be noted before going to the next point. As Popper writes, 'the choice between rationalism and irrationalism.....is not simply an intellectual affair, or a matter of taste. It is a moral decision.'[1] It can be gathered from his writings that rationalism is not for him a matter of intellectual choice in the face of competing viewpoints; but an acknowledgment of the real nature of knowledge; and admittance of a fact.

Popper is right when he says that even purely theoretical issues are important because they have significant moral implications. But then, is not Popper guilty of confusing a fact with a value? Does Popper mean to say that our right or wrong conception about the nature of knowledge can make a world of difference in our ethics, our social and political institutions? The issue appears for Popper that rationalism is intellectually realistic and morally superior to irrationalism. Rationalism, for Popper, logically presupposes liberalism or faith in the dignity and freedom of the individual whilst the greatest drawback with irrationalism, as he says, is its lack of identity or facelessness. It can be identified with either type of the philosophies—authoritarianism as well as with liberalism, still more, in its extreme negative form, it logically implies violence, hatred, inequality, dogmatism and ultimately, authoritarianism and unfreedom. These moral implications of rationalism and irrationalism shall be amplified later. This much is clear that whatever is morally deducible from rationalism is also logically deducibly from the scientific attitude. Critical rationalism, for Popper, is the same as the scientific attitude, which in turn is crystallised in the scientific method.

Now we come to the analysis of Popper's rationalism or his theory of rational knowledge. Knowledge for Popper, to begin with, is an effort of man to solve his significant problems through

1. Popper : The Open Society And Its Enemies, Vol. II, p. 232.

conjecturing solutions to them. This conjectural nature of knowledge means that knowledge is conceived by Popper as a tentative explanation of problems. It is the problem that is important, not the solutions to it, for the solutions may be wrong or perhaps half-truths, and may be individually dropped in favour of a better one. But nobody knows when this 'better one' will make room for an even better explanation. Popper seems to be against attributing any finality or infallibility to human knowledge. To recall Xenophanes : 'All is but a woven web of guesses.' That human knowledge is conjectural, thus criticizable, is one of the main theses of Popper. An important implication that it has for knowledge, is its anti-authoritarian or liberal nature. Popper specially stresses this aspect because it is of special significance against the background of the traditional controversy between rationalism and empiricism. Of the two classical epistemologies, the rationalist or the Continental school was represented by Descartes, Spinoza and Leibniz. The empirical or the British school had its best exponents in Locke, Berkley, Hume and Mill. The main controversy between the two was regarding the authoritative sources of knowledge. The British school insisted that the ultimate source of all knowledge was experience. The Continental school stressed that it was intellectual intuition of clear and distinct ideas.

Popper's is, so for as I know, the most original critique of the two traditions. Their dissimilarity is only apparent, it lies merely in their answers, he says. Their presumptions and their questions are essentially the same : how is true knowledge possible? What are the authoritative sources of knowledge? Both of them share the same tacit assumption that the validity of knowledge depends upon the validity of its source. On the contrary, at the very outset, Popper distinguishes between the origin of knowledge and the truth contained in that knowledge. Forgetting this distinction and confusing truth with its source was the crucial error of traditional epistemologies. Popper's central argument is that all worthwhile knowledge is anthropomorphic. It is of man's making. And man qua man is not equipped by nature to know the final truth about the world. Even if there is one such truth, man cannot grasp it or recognize it as truth by his own native capabilities. This also means that a pristine and ultimate source of true knowledge does not exist in this spatio-temporal world. Truth cannot be derived in a finished form, and once for all, from any single, moreover, authoritative source. It can be acquired from all possible sources

(including reason or sense-data). It is the truth-content of a piece of information that is epistemologically important and not its source. Since truth qua truth is unknown to man, he can only make guesses about it. All human knowledge, then, becomes primarily and potentially, conjectural, a guesswork. A conjecture by its very nature, may be true as well as false, since it epitomises man's inherent fallibility and his truth-seeking (problem solving) fervour. But then truth does not have a genetic identity different from falsehood. Both are intermixed, and can be separated only logically. The logical situations of the two are different. Truth cannot be conclusively asserted or recognized but error can be conclusively detected and eliminated. And it is a great merit of conjectures that they can be profusely aired and freely corrected or criticised. Criticism then becomes an integral part of the truth-seeking, knowledge-acquiring endeavour. Error-detection is a conscious purging of a conjecture, a deliberate and simple attempt to lower its falsity- content and heighten its truth-content. The merit of Popper's ideas lies in their boldness and imaginativeness. Their truth can be guaged by their capacity to stand up to severe tests. They decide, very unobtrusively, the perspective and the ethos of his epistemology of critical rationalism, and also delimit its range.

The central concern of any genuine epistemology should be the truth-content of its theories, says Popper. But, owing to the elusive and a logical nature of truth as mentioned above, this truth-content of theories can be raised only by consciously purging the defects vis-a-vis their problems, rather than by seeking endless confirmations to them. Thus every proper epistemology or philosophy should start with the question : 'how can we hope to detect and eliminate error?' Popper also lays down a proper procedure for systematic error-elimination with regard to theories. What he says about philosophical theories is equally applicable to scientific theories.

Popper's point, therefore, is that any rational epistemology derives its genuineness from its ability to criticise ideas on their own merit rather than by claiming their roots in some alleged true, reliable or foolproof source external to them. Rationalism and empiricism are pseudo-epistemologies for this very reason. By searching for an authoritative source they misrepresent the nature of knowledge. Neither reason nor experience are authorities on truth. Criticism is the only authority. It is the rational nature of

criticism that wins the name of critical rationalism for Popper's epistemology.

The misconception about the nature of knowledge also finds its parallel in a misconception regarding politics—is one of Popper's valuable insights. The question : What is the source of truth?' is akin to the familiar political question : 'who should rule?' Popper says it is basically a wrong political question. It obviously leads to an absolute answer, the example of which are the various theories of sovereignty in political philosophy : the wisest (Plato), the racially superior (Hegel), the general will (Rousseau).

Popper's remarkable insight is that these theories are empirically weak and logically self-contradictory. History shows that even the best of rulers get corrupted with time. Logically, the very idea leads to what Popper calls, the paradox of sovereignty. The greatest problem of politics, therefore, is not to get the wisest of rulers but to control them wisely. Thus instead of asking the stereotyped political question, 'who should rule?' it should be asked, 'how can we so organize political institutions that bad or incompetent rulers can be prevented from doing much damage?'

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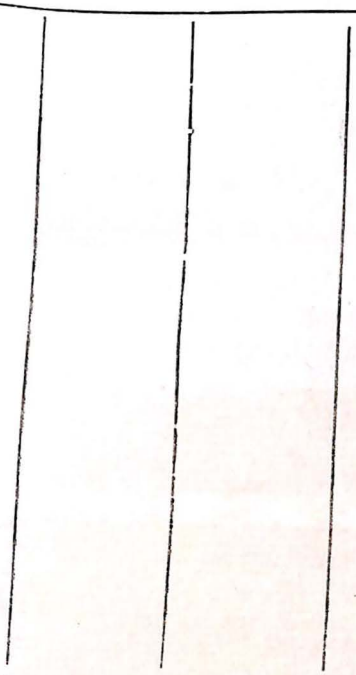

ABOUT THE BOOK

Ever since Hume said that induction was fallacious yet indispensable as the basis of science, the world felt uneasy yet helpless with this fact. Popper's significant advance over Hume lies in revealing not only the fallacy but also the redundance of induction for the purposes of science. Induction neither exists nor does science grow out of it—is Popper's well reasoned stand. The charm and power of science lies in its deductive and falsifiable nature. It is this nature that propels science towards extraordinary discoveries. Popper's is a radical shift from the Baconian presumptions of philosophy of science. And in doing so he interestingly harks back to the ethics of criticizability as embodied by Socrates and the centrality of the knower as epistomised by Kant's epistemology.

This book is an attempt to lay bare in a simple language and for the beginner, Popper's damaging assault on induction and his logical account of how actually does science arrive at those discoveries which make it the invincible force that it is in our world today.

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