Chapter 3

A Review of Some Fundamental Issues of Epistemology
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Ordinarily it is considered that evidence is required, for religious experience to be acceptable. This notion of evidence which is considered to be necessary to support our beliefs comes from our daily life. However, even in cases of scientific beliefs, it is now established, that the evidences only support the beliefs, they don’t form them. In fact we already believe in a theory in support of which we later bring in certain instances and tests which, at the most, corroborate the theory. Evidence can at the most corroborate scientific knowledge; they don’t generate it. Given this understanding a review of some basic issues of epistemology is necessary.

A critique of Evidence

Evidences cannot go beyond a certain boundary of the accepted bulk of knowledge and this results eventually in the realisation that we cannot attain truth with certainty. Evidence is a piece of information in whose truth we believe. When some belief is supported by some evidences then the truth of the belief is accepted because of its link with the belief in truth of the evidence. Evidences serve as a link between prior accepted truths and the truth of the belief that we newly acquire. Evidence is a piece of information whose truth we already believe in (with or without any sufficient reason) on which the rest of the information or the whole of new information is dependent in such a way that if evidence is true the whole information becomes highly probable.

In cognitive understanding of a phenomenon reason is identified with understanding. To understand a phenomenon cognitively is to understand what reason or evidence is in its support. The notion of evidence, thus, becomes centrally important in traditional epistemology. Evidence stands as justification for the truth of a belief in traditional definition of knowledge. However, every sort of knowledge does not require evidence for its support. It becomes questionable whether every kind of knowledge needs evidential support for its justification. Some beliefs are accepted to be true without any
evidence. A belief in the particular colour of an object before one’s eyes is accepted to be true just because one sees that the object is of that colour. No other evidence is needed to believe its truth. There are many other modes of knowing, which can be shown where evidential support is not needed. In those cases where our knowledge is dependent upon some evidence the relation between the truth of the belief and evidence remains problematic. The so-called knowledge which is justified on the basis of evidence does not go beyond the realm of rational doubts. It always remains probable and it lacks certainty which, by implication, takes away the very notion of truth from knowledge.

Even observation is not a simple phenomenon. It also requires the use of a hypothesis in the form of background knowledge. We observe and interpret things by the aid of some theory. Observation is always made in the light of theories. Unless one identifies observation with an immediate, ineffable experience, one has to employ hypothesis in observation. Observation, in any case, is theory laden. No observation is possible without background theories. The problematic nature of theoretical knowledge is a truth that is clearly accepted by contemporary epistemologists and philosophers of science.

Theories can’t be verified, for we are never in a position to observe all the instances of past, present and future. Moreover, theories can never be established by establishing some of its consequences. At the most theories can be falsified, if a falsification instance can be found, but they can never be falsified, if a falsification instance can be found, but they can never be

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24 The hypothesis which directs observation largely determines what factors in the subject matter are noted. It is because of this reason, unless the conditions (which includes hypothesis too) under which an observation is made are known the observation is very unreliable, if not worthless. Changes are most satisfactorily studied when only a single factor (like temperature) is varied at a time, others (like density, atmospheric pressure) being constant (and observed also). Only some theory will lead us to observe all the relevant factors; only a theory will indicate whether atmospheric pressure is a single factor, or whether it may be distinguished into several others, as force is into magnitude and direction.

Only some theory determines what are the relevant factors, among what is observed, and whether they may be distinguished further.

Only primitive observations can be carried out without the aid of instruments, other observations are carried out by the aid of specially devised instruments; observers and interpreters must know the nature and limitations of all such instruments. Their readings must be “corrected” and interpreted in the light of a comprehensive theoretical system. It is because of theories that we have studied about electricity that when we observe an ammeter we are not observing just the needle but current also.
refuted even if some instances/observations contradicting some of its consequences can be found as they may be rehabilitated by adjusting background knowledge (the premises, axioms upon which theory is based), or by providing further auxiliary hypothesis to support them. No conclusive disproof of a theory can ever be produced; for it is always possible to say that the experimental results are not reliable, or that the discrepancies which are asserted to exist between the experimental results and the theory are only apparent and that they will disappear with the advance of our understanding.

Regularities, for instance sun rises in the east and sets in the west, or sun rises daily, or water boils at 100 degree Celsius, which are directly testable by experiment do not change. Though it is conceivable, or logically possible, that they might change; but this possibility, of change in regularity, is disregarded by empirical science and does not affect its methods. In fact scientific method presupposes the immutability of natural processes, the invariance of natural laws with respect to both space and time or the ‘principle of uniformity of nature’.

The above statement expresses the metaphysical faith, which the scientist also has, in the existence of regularities in our world (a faith without which practical action is hardly conceivable).

The ‘principle of uniformity of nature’ expresses a very significant methodological rule which might be derived from a consideration of the non-verifiability of theories.

The ‘principle of the uniformity of nature’ can be regarded as a metaphysical interpretation of a methodological rule.  

The principle of induction normally considered to be the method of science is itself metaphysical in character. The assumption that the principle of induction is empirical leads to an infinite regress. The principle of induction is based upon the principle of uniformity of nature, the belief that future will be just like the past and things will happen the way they have happened in the past. It could therefore only be introduced or considered as a primitive proposition (or a postulate, or an axiom). Principle of induction would have to be treated as a non-falsifiable statement. For if this principle – which is supposed to validate the inference of theories – were itself falsifiable, then it would be falsified with the first falsified theory, because this theory would then be a conclusion, derived with the help of the principle of induction; and this principle, as a premise, will of course be falsified by the modus tollens whenever a theory is falsified which was derived from it. Thus a falsifiable principle of induction would be falsified anew with every advance made by science. It would be necessary therefore, to introduce a principle of induction assumed not to be falsifiable. But this would
The critique of simplicity

Theory choice is generally settled with the methodological principle of simplicity.

The epistemological questions which arise in connection with the concept of simplicity can be answered if we connect this concept with degree of falsifiability. The kind of simplicity involved in Euclidean geometry, for example, seems to have at first sight little to do with degrees of falsifiability. But if statements at issue are formulated as empirical hypotheses, then we find that the two concepts, simplicity and falsifiability, coincide. Euclidean geometrical figures are of lower dimension: they are simpler.

Since theories of a lower dimension are more easily falsifiable than those of a higher dimension. A law having the form of a function of the first degree, for instance, is more easily falsifiable than one expressible by means amount to the misconceived notion of a synthetic statement which is a priori valid, i.e. an irrefutable statement about reality.

Thus if we try to turn our metaphysical faith in the uniformity of nature and in the verifiability of theories into a theory of knowledge based on inductive logic, we are left only with the choice between an infinite regress and apriorism.

Moreover, by induction we cannot arrive at truth, as any future observation may refute our results of induction. Induction can at the most provide us with truths which are only probable.

Only if the asymmetry between verification and falsification is taken into account – that asymmetry which results from the logical relation between theories and basic statements – is it possible to avoid the pitfalls of the problem of induction.

A theory is ‘corroborated’ as long as it stands up to tests.

But the mere fact that a theory has not yet been falsified can obviously not be regarded as sufficient. For nothing is easier than to construct any number of theoretical systems which are compatible with any given system of accepted basic statements. (This remark applies also to all ‘metaphysical’ systems.) The relation that we attempt to establish with truth or with any given system of accepted basic statements may not have any strong basis as we do intend to make and establish relations where in fact none may exist just because we want to connect and relate. We have this natural tendency to find relations. However, there may be another possibility – of relations already existing before we attempt and succeed in finding the true relation. However the question arises, whether the relations we find are already there or are they just man made or manufactured by the mental faculty of man? Relation may or may not be true. How do we know which relation is true?

Basic statements are not derivable from a purely theoretical system (though their negation may be so derivable).

Moreover, the degree of corroboration of a theory can surely not be established simply by counting the number of the corroborating instances, i.e. the accepted basic statements which are derivable. For it may happen that one theory appears to be far less well corroborated than another one, even though we have derived very many basic statements with its help, and only a few with the help of the second.

Since it is mainly the severity of the various tests – to which the hypothesis in question can be, and has been, subjected – which determines the degree of corroboration and not so much the number of corroborating instances. But the severity of the tests, in its turn, depends upon the degree of testability; and thus upon the simplicity of the hypothesis.
of a function of the second degree. But the latter still belongs to the best falsifiable ones among the laws whose mathematical form is that of an algebraic function. As Schlick remarks concerning simplicity that: ‘We should certainly be inclined to regard a function of the first degree as simpler than one of the second degree, though the latter also doubtless represents a perfectly good law. . . .’

A more universal statement can take the place of many less universal ones, and for that reason is called ‘simpler’. The degree of universality and of precision of a theory increases with its degree of falsifiability. Thus we may perhaps identify the degree of strictness of a theory – the degree in which a theory imposes the rigour of law upon nature – with its degree of falsifiability; which shows that the latter does just what the concept of simplicity does.

Simplicity is so highly desirable because knowledge is our object, and simple statements are to be prized more highly than less simple ones because they tell us more as their empirical content is greater and are better testable.

The hypothesis which is falsifiable in a higher degree, or the simpler hypothesis, is also the one which is corroborable in a higher degree.

Theories may be more, or less, severely testable; that is more, or less, falsifiable.

While a theory is falsifiable if there exists at least one non-empty class of its potential falsifiers, i.e. basic statements which are forbidden by it.

A theory which rules out a larger class of basic statements thus resulting in the class of permitted statements becoming smaller says more about the world of experience and has greater number of potential falsifiers, its class of potential falsifiers is ‘larger’ and can thus be easily refuted by experience compared to other theories.26

While the classes of potential falsifiers are infinite, the events forbidden by an empirical theory are also infinite as the conjunction of a forbidden event with any other event is also a forbidden event.27

27 Ibid, pp. 113 - 114.
A theory which forbids too much would be very easy to falsify, since it allows the empirical world only a narrow range of possibilities and rules out almost all conceivable, i.e. logically possible, events. It asserts so much about the world of experience, its empirical content is so great, that there is little chance for it to escape falsification.

Thus the amount of empirical information conveyed by a theory, or its empirical content, increases with its degree of falsifiability.28

It is not possible to arrange the degrees of falsifiability of various statements on one scale, for if we did so, we would be arbitrarily making the non-comparable statements comparable. Where by comparable theories we mean theories which are in the same field and attempt to establish same truths, by non-comparable theories we mean theories which are in different fields and attempt to establish different truths. Whenever we can compare the degrees of falsifiability of two statements, we can say that the one which is the less falsifiable is also the more probable, by virtue of its logical form. One theory which can stand greater attempts at falsification, one which has more truth content and less false content has to be preferred as the more probable to be true, here probable means logically probable, even though it may also be proved to be false in future by any new information. Theories can at the most be falsified, they can’t be proved to be true. Theories which stand falsification attempts contain even those truths which lesser theories which were falsified, attempted to establish, provided both these theories are comparable, i.e. are in the same field and attempt to establish the same truths.29

Also – An experiment in physics can never condemn an isolated hypothesis but only a whole group of hypothesis.30 There are infinite number of theories but there is no guarantee that the theories which we are comparing do contain a true theory, as we may be involved in comparison of false theories. Psychologically we are inclined to establish relations where none

28 Ibid, p. 113.
29 Ibid, pp. 118 - 123.
may exist. Thus many theories may in fact be involved in wrongly establishing relations.

*Empirical content* of a statement increases with its degree of falsifiability: the more a statement forbids, the more it says about the world of experience.

‘Empirical content’ is closely related to, but not identical with, ‘logical content’.

The *empirical content* of a statement $\phi$ is defined as the class of its potential falsifiers. While the *logical content* is defined, with the help of the concept of derivability, as the class of all non-tautological statements which are derivable from the statement in question. (It may be called its ‘consequence class’.)

While comparing degrees of testability or of empirical content we shall in the case of purely empirical statements arrive at the same results as in comparing logical content, or derivability-relations. Thus it will be possible to base the comparison of degrees of falsifiability to a large extent upon derivability relations. A self-contradiction entails every statement and a tautology is entailed by every statement. Degree of falsifiability of empirical statements falls into the open interval which is bounded by the degrees of falsifiability of self-contradictions on the one side, and of tautologies on the other. Similarly, *synthetic* statements in general (including those which are non-empirical) are placed, by the entailment relation, in the open interval between self-contradiction and tautology.

Thus the comparison of the empirical content of two statements is regarded as equivalent to the comparison of their degrees of falsifiability. This makes our methodological rule that those theories should be given preference which can be most severely tested equivalent to a rule favouring theories with the highest possible empirical content.

The demand for the highest attainable degree of *universality*, and the demand for the highest attainable degree of *precision* may be reduced to the demand for the highest possible empirical content.
If of two statements both their universality and their precision is comparable, then the less universal or less precise is derivable from the more universal or more precise; unless one is more universal and the other more precise i.e. unless they are incomparable. Demand for the highest attainable degree of universality and precision can be reduced to the demand, or rule, that preference should be given to those theories which can be most severely tested.

The degree of corroboration actually attained does not depend only on the degree of falsifiability. A statement may be falsifiable to a high degree yet it may be only slightly corroborated, or it may in fact be falsified, or it may, without being falsified, be superseded by a better testable theory from which it can be deduced.

Although a numerically calculable degree of corroboration can’t be defined, but one can speak in terms of positive degrees of corroboration and negative degrees of corroboration. Yet one can lay the rule that one will not continue to accord a positive degree of corroboration to a theory which has been falsified by an inter-subjectively testable experiment based upon a falsifying hypothesis.

In general an inter-subjectively testable falsification is regarded as final. This is the way in which the asymmetry between verification and falsification of theories makes itself felt.

A corroborative appraisal made at a later date – that is, an appraisal made after new basic statements have been added to those already accepted – can replace a positive degree of corroboration by a negative one, but not vice versa.

In the history of science it is always the theory and not the experiment, the idea and not the observation, which opens up the way to new knowledge, although it is always the experiment which saves from following a track that leads nowhere.

The degree of falsifiability or of simplicity of a theory enters into the appraisal of its corroboration. This appraisal may be regarded as one of the logical relations between the theory and the accepted basic statements: as an
appraisal that takes into consideration the severity of the tests to which the theory has been subjected.

In appraising the degree of corroboration of a theory its degree of falsifiability is taken into account. A theory can be better corroborated the better testable it is. However, testability is converse to the concept of logical probability. Thus, we can also say that an appraisal of corroboration takes into account the logical probability of the statement in question. This, in turn, is related to objective probability – the probability of events. Thus by taking logical probability into account the concept of corroboration is linked with the probability of events.\footnote{Popper, Karl R., \textit{The Logic of Scientific Discovery}, Hutchinson and Co. Ltd., London, 1959, p. 269.}

The degree of corroboration of a theory will increase with the number of its corroborating instances. The degree of corroboration of a theory which has a higher degree of universality can thus be greater than that of a theory which has a lower degree of universality (and therefore a lower degree of falsifiability). Similarly, theories of a higher degree of precision can be better corroborated than less precise ones.

That hypothesis is simple which has no or minimum number of auxiliary hypotheses supporting it. A hypothesis which is supported and defended and strengthened (and/or protected) by auxiliary hypotheses each time it is attacked becomes too strong or complex to be indefeatable or nonfalsifiable, it does not remain simple any more. A system is complex in the highest degree if one holds fast to it as a system established forever which one is determined to rescue, whenever it is in danger, by the introduction of auxiliary hypotheses. The degree of falsifiability of a system thus protected is equal to zero.

Simplicity must be logically defined and not defined within a system as a thing defined within a system though it may appear to be simple within the system but it may be really very complex.

The simple theories are those which make little use of auxiliary hypothesis. We ascribe a high probability (a high ‘probability of hypotheses’)

to *simple* theories, and especially to those needing few auxiliary hypothesis, because they are severely testable, or logically improbable; that is to say because they have, *a priori* many opportunities of clashing with basic statements.

*Simplicity in the sense of high testability*, because of high falsifiability, leads to the rule that auxiliary hypothesis should be used as sparingly as possible and that the number of our axioms should be kept down. This point arises out of the demand that statements of a high level of universality should be chosen, and that a system consisting of many ‘axioms’ should, if possible, be deduced from (and thus explained by) one with fewer ‘axioms’, and with axioms of a higher level of universality.

Physics evolves from theories of a lower level of universality to theories of a higher level.

Advance in the inductive direction does not necessarily consist of a sequence of inductive inferences. It may be explained in quite different terms – in terms of degree of testability and corroborability. For a theory which has been well corroborated can only be superseded by one of a higher level of universality, by a theory which is better testable and which, in addition, contains the old, well corroborated theory – or at least a good approximation to it.

The trend of the advance towards theories of an ever higher level of universality may be described as ‘quasi-inductive’.

The quasi-inductive process should be envisaged as follows. Theories of some level of universality are proposed, and deductively tested; after that, theories of higher level of universality are proposed, and in their turn tested with the help of those of the previous levels of universality, and so on. The methods of testing are invariably based on deductive inferences from the higher to the lower level; on the other hand, the levels of universality are reached, in course of time, by proceeding from lower to higher levels.

Those theories which are on too high a level of universality, that is, too far removed from the level reached by the testable science of the day, give rise to a ‘metaphysical system’. In such a case, even if from this system statements
should be deducible, which belong to the prevailing scientific system, there will be no new testable statement among them. It means that no crucial experiment can be designed to test the system in question. If, on the other hand, a crucial experiment can be designed for it, then the system will contain some well corroborated theories, and also some thing new – and something that can be tested. Thus the system will not be ‘metaphysical’. In this case, the system in question may be looked upon as a new advance in the quasi-inductive evolution of science.

**Critique of the role of crucial experiment and the idea of scientific research program.**

The scientific research program may be degenerating or progressive.\(^{32}\) It all depends upon what is our paradigm, if old paradigm then nothing new can be found, as no new questions arise.\(^{33}\) Science progresses when there is some problem, which demands an explanation and to explain the problem a theory is devised, and the theory explains other than this particular problem, many other problems also, while it predicts about future events also. But to explain the prediction, is itself a problem which is solved – either by adjusting the assumption, the background knowledge, or by supporting the assumption and theory by auxiliary hypothesis – or by going ahead, to challenge even the assumption, the background of the theory, in a new direction, to gain new knowledge. Thus breaking the shackles which belief in old knowledge (to be true) was imposing upon one’s scientific growth of new knowledge.

This explains why a link with the science of the day is as a rule established only by those theories which are proposed in an attempt to meet the current problem situation; that is, the current difficulties, contradictions, and falsifications. In proposing a solution to these difficulties, these theories may point the way to a crucial experiment.

Though commonly it is believed that a *single crucial experiment* may often decide between two rival theories, which are comparable – for if one theory implies an experimentally certifiable proposition which contradicts a

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\(^{33}\) Ibid, pp. 133 – 152.
proposition implied by a second theory, by carrying out the experiment, one can definitely eliminate one of the theories – but this is not the case.\textsuperscript{34}

Therefore, every experiment tests not only an isolated hypothesis, but the \textit{whole body} of relevant knowledge logically involved. If the experiment is claimed to refute an isolated hypothesis, this is because the rest of the assumptions we have made are believed to be well founded. But this belief may be mistaken.\textsuperscript{35}

\textsuperscript{34} As we see that the case where suppose, if $H_1$ - the hypothesis that light consists of very small particles traveling with enormous speeds - and $H_2$ - the hypothesis that light is a form of wave motion - are two hypothesis attempting to explain the same class of events $E$ - the rectilinear propagation of light, the reflection of light, the refraction of light. Where $H_1$ implies the proposition $p_1$ that the velocity of light in water is greater than in air; while $H_2$ implies the proposition $p_2$ that the velocity of light in water is less than in air. Now $p_1$ and $p_2$, both can't be true together, is an ideal case for performing a crucial experiment, as if $p_2$ could be confirmed by experiment, then $p_1$ would be refuted, and we could then argue, and argue validly, that the hypothesis $H_2$ cannot be true. But still no hypothesis could be rejected, even though Foucault was able to show that light travels faster in air than in water, which must have resulted in the rejection of $H_1$, i.e. Newton's corpuscular hypothesis for ever, but that was not to happen mainly because of the way in which observations made by us and theories are interrelated. In order to deduce the proposition $p_1$ from $H_1$, and in order that we may be able to perform the experiment of Foucault, many other assumptions, $K$, must be made about the nature of light and the instruments we employ in measuring its velocity. Consequently, it is not the hypothesis $H_1$ alone which is being put to the test by the experiment – it is $H_1$ and $K$. Thus the logic of the crucial experiment is: If $H_1$ and $K$, then $p_1$; but $p_1$ is false; therefore either $H_1$ is false or $K$ (in part or completely) is false. Now if we have good grounds for believing that $K$ is not false, then $H_1$ is refuted by the experiment. The experiment really tests both $H_1$ and $K$. If in the interest of the coherence of our knowledge it is found necessary to revise the assumptions contained in $K$, the crucial experiment must be reinterpreted, and it need not then decide against $H_1$.

\textsuperscript{35} This point may be made clear by another illustration. Suppose we wish to discover whether our “space” is Euclidean, that is, whether the angle sum of a physical triangle is equal to two right angles. We select as vertices of such a triangle three fixed stars, and as its sides the paths of rays traveling from vertex to vertex. By making a series of measurements we can calculate the magnitude of the angles of this triangle and so obtain the angle sum. Suppose the sum is less than two right angles. \textit{Must} we conclude that Euclidean geometry is not true? Not at all! As there are at least three alternatives open to us:

1. We may explain the discrepancy between the theoretical and “observed” values of the angle sum on the hypothesis of errors in measurement.
2. We may conclude that Euclidean geometry is not physically true.
3. We may conclude that the “lines” joining the vertices of the triangle with each other and with our measuring instruments are not “really” straight lines; that is, Euclidean geometry is physically true, but light does not travel in Euclidean straight lines in stellar space.

If we accept the second alternative, we do so on the assumption that light is propagated rectilinearly, an assumption which, although supported by much evidence, is nevertheless not indubitable. If we accept the third alternative, it may be because we have some independent evidence for denying the rectilinear propagation of light; or it may be because a greater coherence or system is introduced into the body of our physical knowledge as a consequence of this denial.
Thus “Crucial experiments” are crucial against a hypothesis only if there is a relatively stable set of assumptions which we do not wish to abandon. But no guarantees can be given that some portion of such assumptions will never be surrendered.

All these metaphysical concepts and ideas (like atomism, ultimate element) may have helped, even in their early forms, to bring order into man’s picture of the world, and in some cases they may even have led to successful predictions. Yet an idea of this kind acquires scientific status only when it is presented in falsifiable form; that is to say only when it becomes possible to decide empirically between it and some rival theory. But that is problematic.

Even for evidence to work efficiently, to provide us knowledge we must have some basic axioms, some certain truths to begin with. No clear answer is available of the question - from where do we get these axioms, background knowledge, and the methods to evaluate and compare. We believe and have faith in the truth of these axioms and even in the truth of methods of evaluation and comparison, but it is to notice that it is a belief that is not testable.

The gist of the review

The demand for justification of a belief itself raises certain questions because all experiences can’t be substantiated on the basis of evidence, proofs can’t be given of recent memory, or perception or belief in other minds. We just know that we have perception, faith, etc., we know that there are other minds and we do have recent memory, and we do believe in whatsoever we know. One can’t ask for, or give justification of perception, other minds and recent memory, as they are directly apprehended. Moreover the notion of proof itself needs to be examined. Proof is a method by which from some believed truth, by relations and deductions, we arrive at the desired truth. We have already considered that man may make relations where none may exist, but relations may also be directly apprehended. By deductions we arrive at no new truths but at truths which are already contained in the initial statement. Thus no real advancement in empirical knowledge can be made by proofs.
Science is not a system of certain irrefutable statements; nor is it a system which steadily advances towards a state of finality. Our science is not that knowledge which can ever claim to have attained truth, or even a substitute for it.

Yet Science has more than mere biological survival value. It is not only a useful instrument. Although it cannot attain truth, the striving for knowledge and the search for truth are still the strongest motives of scientific discovery.

We do not actually claim to know: we can only conjecture. Our conjectures are guided by the metaphysical (though biologically explicable) faith in laws, in regularities which we can discover.

These (imaginative and bold) conjectures or ‘anticipations’ are controlled by systematic tests. Once put forward, none of our ‘anticipations’ are dogmatically held. Scientific method of research is not to defend them, in order to prove how right we are. On the contrary, we try to falsify them.

The description of scientific progress - ‘by gathering new perceptual experiences, and by better organizing those which are available already’, though not wrong, is too reminiscent of induction.

The advance of science is not due to the fact that more and more perceptual experiences accumulate in the course of time. Nor is it due to the fact that we are making ever better use of our senses. Out of uninterpreted sense-experiences science cannot be distilled, no matter how industriously we gather and sort them.

Bold ideas, unjustified anticipations, and speculative thought, are our only means for interpreting nature: our only organon, our only instrument, for grasping her. One must hazard them to gain knowledge. Those who are unwilling to expose their ideas to the hazard of refutation do not take part in the scientific game.

Even the careful and sober testing of our ideas by experience is in its turn inspired by ideas: experiment is planned action in which every step is governed by theory. We do not stumble upon our experiences, nor do we let them flow over us like a stream. Rather, we have to be active: we have to
“make” our experiences. We formulate the questions to be put to nature; we put these questions to elicit a clear-cut ‘yes’ or ‘no’. And, it is again we who give the answer; we ourselves who, after severe scrutiny, decide upon the answer.

One may get a clear picture of science in Weyl’s statement - ‘Once and for all I wish to record my unbounded admiration for the works of the experimenter in his struggle to wrest interpretable facts from an unyielding Nature who knows so well how to meet our theories with a decisive No – or with an inaudible Yes.’

The old scientific ideal of epistêmê – of absolutely certain, demonstrable knowledge – has proved to be an idol. The demand for scientific objectivity makes it inevitable that every scientific statement must remain tentative for ever. It may indeed be corroborated, but every corroboration is relative to other statements which, again, are tentative.

With the idol of certainty (including that of degrees of imperfect certainty or probability) there falls one of the defences of obscurantism which bars the way of scientific advance, checking the boldness of our questions, and endangering the rigour and the integrity of our tests. The wrong view of science betrays itself in the craving to be right; for it is not his possession of knowledge, of irrefutable truth, that makes the man of science, but his persistent and recklessly critical quest for truth.

Science never pursues the illusory aim of making its answers final, or even probable. Its advance is, rather, towards the infinite yet attainable aim of ever discovering new, deeper, and more general problems, and of subjecting its ever tentative answers to ever renewed and ever more rigorous tests.

Thus from the above review it becomes clear that scientific knowledge is always theory impregnated and is conjectural in character. We postulate theory first and make observations in its light. So observation in our so called cognition is theory laden. Theories are accepted because of their heuristic (explanatory) power. A theory tries to explain a phenomenon but explanation is not a guarantee of truth. Theories are conjectures which may be refuted by a new counter evidence. Any new information, which is contrary to the explanation provided by the theory, may prove to be an instance for the
refutation of the theory. Theories at the most can claim to help us reach near
the truth or provide greater truth content but they can’t give us certainty about
the truth of the phenomenon. More than one theories can explain the same
phenomenon. Which one of them is better or progressive – is decided on the
ground of their power to add more truth content to our available bulk of
knowledge. However, this is not the proof of certainty of that truth. In the
history of science it is shown several times that what was once believed to be
certainly true, was proved to be a false belief in the light of new counter
example (for e.g. the case of ether). The belief in the truth of a theory is
accepted on the ground of the instances that it predicts. But as it was discussed
earlier observation itself is theory laden. Hence the truth of the theoretical
belief and the truth of the observed instances end up in theoretical framework
only and the realistic link that is intended to be established can never touch the
reality with certainty. While by induction we can, at the most, attain truths
which are probable, lack certainty and can be doubted. While by deduction we
cannot proceed beyond what we already have or know, and thus can’t attain
any new knowledge, or truth. Thus, we can never attain truth and certainty, in
Science.

In the attempt of over emphasizing the notion of evidence traditional
epistemology fails to secure certainty not only about newly discovered truths
but also fails to recognize truths that are directly apprehended, for which
evidence is not required. A belief may be without any evidence. In direct
apprehension no such evidence is required, belief comes with apprehension. In
traditional epistemology it is completely overlooked that the link between the
truth of theoretical belief and the truth of the evidence is also a directly
apprehended link. If we go into a thorough analysis of the steps between a
theoretical belief and the evidence that supports it, we find that every step is
related to another with direct apprehension. Truths may be related to each
other in the world of objective knowledge but they become our knowledge
only when they become objects of direct apprehension.

Scientists and philosophers of science believe that there are no truths in
science and certainty was lost many centuries ago. But we continue to accept
science because it gives us technology and good living standard and helps us control and influence our immediate environment. To believe that science gives us truth is an unfounded belief.