CHAPTER III

DEDUCTIVE STANDARD OF JUSTIFICATION

The scientists, by observing the external world, came to the general view that Nature is uniform. The nature has infinite variety, which is reduced in order and thus demands to be intelligible. This demand is based on the assumption that there are some conditions with regard to the way, things are happening and with regard to the relation which is obtained between the scientists and nature. The scientists must necessarily fulfil these conditions, because if they fail to do so the exact order of the natural occurrences cannot be discovered properly by them. The scientists accept these conditions as self-evident without any proof. Similarly, the fulfillment of these conditions is incapable of disproof.

The scientists must be based on the existent world for their starting-point of investigation, which is the sufficient justification for postulating the conditions and they would not move otherwise. The investigation, which is done by the scientists, is based on their assumption, which leads to the interesting and verifiable conclusions. At this point, the logicians may further ask the scientists as to whether these conclusions are valid which are obtained by their own method. The scientists are facing some problems of scientific method and it is the duty of the scientists to
find out what exactly the problem is. It is an undeniable fact to deny that we all do believe many general propositions about the existent world. We generally believe that ‘fire burns’, that arsenic is poisonous and so on.\(^1\) In accordance with Hume it is always true that in inductive reasoning the premises cannot guarantee the probability of a conclusion. But this account could show a problem about our knowledge of the external world because without induction no informative generalisations of the world could be justified. The generalisation that “the fire burns” is a necessary truth because the contradictory of such generalisation could not be conceived as false. It is inconceivable that fire does not burn. But such generalisation could be justified only by an appeal to experience and the only way to justify its generalisation is possible by induction.

Even many scientific theories also contain the general ideas. Newton’s theory of mechanics is an instance of generalisation. Newton’s First Law is stated as follows:

All objects which are not acted upon by a force will continue forever in a state of rest or uniform straight-line motion.\(^2\)

Pasteur’s Germ theory is another instance of generalisation, when we say:

All infectious diseases are caused by Micro-organisms.\(^3\)
There are different stages of scientific method, which are as follows:
(1) Collection of evidence.
(2) Generalisation to formulate a hypothesis.
(3) Deductive development of hypothesis.
(4) Verification of deductive conclusions.
(5) Verification of the hypothesis

All scientific generalisations which are accepted largely by the scientists ideal with both the past and the future, and also deal with what has been observed and as such we do believe these propositions, it means that these propositions are certain and true. There are some propositions such as, $2 + 2 = 4$ or such as ‘the three angles of a triangle is equal to two right angles’ which are somehow different from the propositions such as ‘fire burns’ or ‘all ravens are black’. Here the first two propositions are the matters of fact asserted by the propositions and so we have the changing attitude between the first two and the second two propositions.

The scientists assume that these generalisations can be possible by some reliable procedure and by using such reliable procedure they can apparently justify some general propositions with regard to the existent world. They regard that these general propositions are asserted in the natural sciences. It is believed that deductive reasoning is the most reliable reasoning where the truth of the conclusion depends upon the truth of the premises. So the scientists must use deductive procedure to justify such generalisations. But on an examination we can say that deductive
reasoning can justify propositions of complicated statements already known; it cannot justify the statements, which are our observation. So it is not possible to justify the statements which are within our observation. But Newton and many other scientists offer a very plausible suggestion, which is that it is by using inductive reasoning by which the scientists are able to justify generalisations. Thus we can say that the validity of scientific method depends upon the truth of induction.

Inductive reasoning cover several different non-deductive forms of arguments. Although, the term "induction" is generally associated with empirical generalisation, of which the simple case is to infer from all observed members of a class "'A' have a property of 'B'" that all unknown members of the class will have the same property; 'All A's are 'B's'. The most basic type of inductive reasoning is a simple enumerative induction of the form: "All observed A's have been B's, therefore, 'All A's are B's', where we infer from a premise with regard to some A's to a conclusion with regard to all A's. In simple enumerative induction, we also establish generalisation that "All ravens are black" from 500 ravens, which are black and from the fact that no non-black raven has been found. Inductive reasoning is not only essential for the scientists to justify their theories, but it is also essential to our everyday life. We know only by reasoning inductively that "bread nourishes" because it has nourished people in the past and thus we come to the conclusion that
'bread always nourishes. Hence, we can say that the conclusions derived from simple enumeration must be probable though it is based on strong probability.

The term ‘induction’ is generally ascribed with four different modes such as:

(1) The first group contains arguments supporting conclusions about objects of the same kind.
(2) The second group consists of arguments supporting generalisations about objects of the same kind.
(3) To the third group belongs arguments leading to conclusion concerning causal relations or explanatory hypothesis, and
(4) To the fourth group belongs argument, involving judgements of probability.

In the first group of inductive argument we can have the example like: the conclusion that the earth is spherical is a conclusion in which a predicate is ascribed to a single entity.

This example is taken from one of the arguments of Aristotle, which may be reconstructed thus:

If the earth is spherical then different stars would be seen in the south than in the north.

Different stars are seen in the south than in the north.

Hence, the earth is spherical.

Judged as a deductive argument, this argument is not valid, because it commits the fallacy of affirming the consequent. But the reasons advanced are quite
relevant to the establishment of the conclusion. The minor premise together with the acceptability of the major premise, presents a new fact for arriving at the conclusion. Such forms of arguments are very often used for establishing conclusions about single individuals.

Another argument form sometimes offered for prediction about an individual entity is called analogy. The following example may be considered:

The planet Mars possesses an atmosphere with clouds and mists resembling our own; it has seas distinguished from the land by a greenish colour, and polar regions covered with snow. The red colour of the planet seems to be due to the atmosphere like red colour of our sun rises and sun sets. So much is similar in the surface of Mars and the surface of the Earth that we readily argue that there must be inhabitants there as here.  

This argument may be rephrased as follows to bring out its form:
The Earth has:
(a) an atmosphere,
(b) clouds and mists,
(c) seas,
(d) land with greenish colour,
(e) polar regions covered with snow,
(f) red colouring on occasion in its atmosphere and
(g) inhabitants.

Mars has:
(a) an atmosphere,
(b) clouds and mists,
(c) seas,
(d) land with greenish colour,
(e) polar regions covered with snow,
(f) red colour in the atmosphere.

Hence, Mars has
(g) inhabitants.

In this argument, from the presence of many similar predicates between the planets Earth and Mars, it is inferred that an additional predicate namely, ‘having inhabitants’ which belongs to the Earth, similarly, belongs to the planet Mars. In analogies, we presuppose that the two objects differ in many predicates, it is difficult to infer that they will agree in the presence of many arbitrarily selected predicates. Many analogical arguments are incorrect. However, analogical arguments are very useful in scientific discoveries and investigation.

The second group of inductive arguments is that sometimes it is possible to establish an empirical generalisation by a deductively valid argument if the generalisation is about a limited number of entities, all of which, can be counted thus; ‘All students in the logic class in this year are right-handed’ can be established by statements about its individual student
concern. Such generalisations about limited cases are usually known as summary induction or induction by complete enumeration, and they are generally advanced deductively usually in syllogistic form.

We are here concerned with the empirical generalisations, which are supported by non-deductive arguments. Such generalisations and the arguments supporting them called inductive arguments. The simplest form of inductive generalisation would be an argument in which a single simple predicate is applied to all things. An argument for the generalisation 'everything is physical' could contain an unlimited number of relevant and confirming instances, such as 'my hand is physical', 'this desk is physical', 'that tree is physical', 'that dog is physical' and would have the form:

\[
Pa \\
Pb \\
Pc \\
Pd
\]

\[
(x) \, Px
\]

The form of argument above, provides a clue to the sort of assumption which underlies all inductive generalisations. The statements 'All men are mortal' and 'All mammals have hair' are significant generalisations.

The inductive argument that 'All men are mortal' is based on the confirming instances of every men who
has ever died. In a sense, men now living who are not get death are possible counter examples since they have not go yet chances to be mortal. But these counter examples are easily accounted for by the common assumption that men may ordinarily live up to a limited range of longevity. If we know of one man born two thousand years ago but still living, the generalisation may be doubted; but we know of such man. The same sorts of considerations make the inductive generalisation to ‘All mammals have hair’ a sound generalisation to the zoologists.

In the third group, a common distinction is made between mere knowledge of facts and understanding of why facts are as they are. This distinction is more or less the distinction between description and explanation, though they are interrelated.

In judging the soundness of an inductive argument is to say whether the data collected constitute a ‘fair sample’. In general, the criteria of a fair sample relative to a given generalisation depends on the scope of that generalisations and assumptions about the kinds of variations found on the subject-matter covered. A generalisation has a widest conceivable scope if it is asserted of every object whatever, regardless of time, place or characteristics. Logical theorems have these characteristics but these theorems cannot be established by inductive generalisations. Many inductively established generalisations are asserted of
all times and places, although they are usually restricted to certain kinds of objects.

The enumerative factors as well as analogical factor are also effecting the strength of inductive inference. The enumerative factor states that other things being equal the more cases in the premises of an inductive argument, the stronger the argument. Similarly, other things being equal the more similarities shared by cases in the conclusion, the more likely it is that the cases in the conclusion will share further similarities with cases in the premises.

Fourthly, inductive generalisations may be contrasted with those generalisations in which we infer that something will be true not of all members of the class, but of a certain propositions of them only. Induction of this kind may be called statistical induction or statistical generalisations. Such generalisations play important role in scientific enquiry, both in social sciences and in mathematical physics. These generalisations speak about finite proportions of infinite multitudes of elements.

Suppose we take a pack of playing cards and remove all red cards except one, shuffled and cut the remaining twenty seven cards consequently again and again and laid the semi pack face down on the table. We would then consider the statement ‘I believe that the top card is black’, reasonable; but would be quite surprised and critical of any one who seriously said ‘I believe the top card is red’, without being able to give additional reasons for his belief. The reasons to believe
the top card black may have some arguments like:

The pack contains 26 black cards but only one red card.
The top card, so far as we know, could be anyone of the 27.
Hence, I believe that it is black.

Or,
The chances are 26 to one that the top card is black. Hence, I believe it is black.

This is clearly a non-deductive argument. Here the conclusion can be false without being inconsistent with the premises. Yet we may say that the argument is sound.

Although these patterns of arguments do not exhaust the class of arguments called inductive they are recognised as the main forms of inductive arguments. On an examination it is found that induction and deduction are mutually support each other. Again, both the forms of inference are equally used in scientific inquiry. But demonstrative inference is antithetical to non-demonstrative inference. Demonstrative inference is conclusive because in it if the premises are true the conclusion is also true. But non-demonstrative inference is non-conclusive because the truth of the premises does not guarantee the truth of the conclusion. In deductive or demonstrative argument, the conclusion follows necessarily from the conjunction of the premises. The conclusion is a logical consequence of the conjunction of the premises, whereas this process does not apply to induction.
In inductive arguments, we find a relation between the premises and the conclusion. But in the case of deduction, the relation is different where we have the logical relation of implication between the premises and the conclusion.

Premises:
(1) In that room, there are John, James and Thomas
(2) One of them is red-haired.
(3) John and James are not red-haired.
Therefore, Thomas is red-haired.

This is a deductive argument in which the premises are sufficient and necessary to prove the truth of the conclusion. In other words, the premises can establish the truth of the conclusion. Again,

Premises:
(1) The metal iron conducts electricity.
(2) The metal gold conducts electricity.
(3) The metal silver conducts electricity.
Therefore, All metals conduct electricity.

When we symbolise this argument with the help of quantifier, we have the following:

(1) Mi.Ci
(2) Mg.Cg
(3) Ms.Cs
Therefore, (X) (Mx.Cx)

This is an inductive form of argument in which what is true of the observed cases is true of the remaining members of a class where similar properties should have occurred. Moreover, the conclusion which is known as inductive generalisation is a general
proposition of the form “All A’s are B’s”, for instance, “All metals conduct electricity”. But a logical problem is involved in the analysis of such propositions. Thus in logic the sentence “All A’s are B’s, is analysed as ‘given anything as A, it follows that the samething is B’, or better ‘given any x, if X is A, then X is B’; and this is symbolised as (X) (Ax > Bx). Similarly, the general proposition- “All metals conduct electricity” means given any X, if X has the property of being a conductor of electricity. It follows that if ‘iron is a metal, then’ iron conducts electricity’. Now, the problem arises whether there is a logical relation of implication between being an iron and being a conductor of electricity.

It is, however, not necesasary that an inductive inference should lead to a generalisation. But a distinction is sometimes made between two kinds of induction: (i) from particular to universal and (ii) from particular to particular. Some logicians, particularly John Stuart Mill is of the opinion

Induction is a process of inference from particular to particular.6

Induction is sometimes conceived as a method that leads on the basis of observation of some but not all, from the particular instances to corresponding general conclusion. Thus we have the problem as, is it possible to draw a general conclusion on the basis of observation of some and not of all particular facts?
This is a genuine problem. Actually, this problem belongs to the philosophy of logic and as such the problem is logical. Again, when the problem is arranged like whether it is possible to come to believe that the conclusion which is general is derived without observing the truth of each of the particular fact, then the problem is somehow psychological which can be solved easily.

When we try for the logical solution to the problem of induction, it is actually regarding with the justification of the problem of induction. The problem of justification arises out of Hume’s thesis of impossibility of giving a logical solution to the problem.

Hume claims that we cannot even seek to provide justification of inference because he says:

You must confess that the inference is not intuitive; neither is it demonstrative: of what nature is it, then? To say it is experimental, is begging the question. For all inferences from experience suppose, as their foundation, that the future will resemble the past, and that similar powers will be conjoined with similar sensible qualities. If there be any suspicion that the course of nature may change, and that the past may be no rule for the future, all experience becomes useless, and can give rise to no
inference or conclusion. It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future; since all these arguments are founded on the supposition of that resemblance.⁷

Again, he says that all things in the universe, do not always behave as we expect. Regarding this he raises some questions as:

why may (this) not happen always, and with regard to all objects? What logic, what process of argument secures you against this supposition?⁸

The answer which is given by Hume is easier one though the inductive inference is some what more complicated matter. Hume answers that we have no justification for believing that things will continue to behave as they have behaved in the past. Still we do believe this and also act on this, which is matter of animal habit. So Hume has clearly stated that there is no justification of inductive inference.

Paul Edwards is the only one of many writers, who is supposed to be the representative of analytic approach. P.F. Strawson and Stephen Barker also develop an analytic justification. The analytic justification of induction claims that:
what we mean by an inference being a correct inductive inference, its conclusion being more probable than any rival (or alternatively by the conclusion being probable), just is that it is a conclusion reached by our current inductive procedures, using the criteria which we do use for judging inductive argument correct. What justifies us in using those criteria is that, in so far as those criteria pronounce some claim probable, then (of logical necessity) it is probable.  

Paul Edwards before going to explain this justification has shown that Bertrand Russell in the chapter ‘Induction’ in his Problems of Philosophy asks the question:

have we any reason, assuming that they [laws like, the law of gravitation] have always held in the past to suppose that these laws will hold in the future?  

Again Russell raises another more specific question:

Do any number of cases of a law being fulfilled in the future?
Edwards claims that both these questions when reformulated themselves lead to the following critical discussion:

(1) Assuming that we possess n positive instances of a phenomenon, observed in extensively varied circumstances, and that we have not observed a single negative instance (where n is a large number), have we any reason to suppose that the n+1st instance will also be positive?

(2) Is there any number n of observed positive instances of a phenomenon which affords evidence that the n+1st instance will also be positive?  

Russell asserts that both these questions cannot but answer in the negative unless we appeal to a non-empirical principle, which he calls inductive principle.

Russell further holds that the principle of induction is at the bottom of all inference, which are non-empirical. In his own words:

Those who were interested in deductive logic naturally enough ignored it, while those who emphasised the scope of induction wished to maintain that all logic is empirical, and therefore could not be ex-
pected to realise that induction itself, their own darling, required a logical principle which obviously could not be proved inductively, and must therefore be a priori if it could be known at all.\textsuperscript{13}

Thus in his view inductive principle is incapable of being disproved by an appeal to experience. He says,

thus we must either accept the inductive principle on the ground of its intrinsic evidence, or forgo all justification of our expectations about the future.\textsuperscript{14}

Russell, now, contends in conjunction with the inductive principle that the question (1) can be at least answered in the affirmative. But regarding the question (2) he makes no clear idea whether it can be answered in the affirmative like (1). To him the principle of induction further states that:

Whether inferences from past to future are valid depends wholly, if our discussion has been sound, upon the inductive principle: if it is true, such inferences are valid and if it is false, they are invalid.\textsuperscript{15}
Paul Edwards goes against the view of Russell and now, tries to show that the question (1) without appealing to non-empirical principle can be answered in affirmative way. Even he tries to show that without any way of appealing to a non-empirical principle, numbers of observed positive instances do frequently afford us evidence that unobserved instances of that phenomenon are also positive. He further adds that the question (1) is the most general question which is to be concentrated and once the question (1) is answered the question (2) will require less difficulty to answer. The main object of Edwards is to defend the common-sense answers to both of Russell’s questions. He says:

I propose to show, in other words that, without in any way calling upon a non-empirical principle for assistance, we often have a reason for supposing that a generalisation will be confirmed in the future as it has been confirmed in the past.\(^\text{16}\)

He also proposes to show that:

Numbers ‘of cases of a law being fulfilled in the past’ do often afford evidence that it will be fulfilled in the future.\(^\text{17}\)
Whenever we turn to question (2) we find that Edwards has mentioned the fact that scientists as well as some so-called intelligent ordinary people do not rely exclusively on the number of observed positive instances for their inductive conclusions. The answer to the question (2) is admitted to be a clear ‘no’. It has two reasons:

Firstly, even if there were in every domain or, in some domains a number of observed positive instances which constitutes the dividing line between evidence and non-evidence or, as it is more commonly expressed, between sufficient and insufficient evidence, there is no reason whatsoever to suppose that the number would be the same for the different domains. But, secondly, there is no such number in any domain. For we are here clearly faced with a case of what is sometimes called continuous variation.  

It is thus clear that nothing is implied against commonsense by these facts. Edwards says that Russell’s claim is that any justification of induction whether empirical or inductive cannot be empirically possible since it leads to begging the question. As Russell says:
If the principle of induction ‘is not true’, every attempt to arrive at general scientific laws from particular observations is fallacious, and Hume’s scepticism is inescapable for an empiricist. But ‘the principle itself cannot, without circularity, be inferred from observed uniformities, since it is required to justify any such inference.’

According to Russell, observed instances are never by themselves a reason for an inductive conclusion. When he says so, he is guilty of an ignoratio elenchi by redefinition. By ‘reason’ Russell means like the rationalists and Hume ‘a logically conclusive reason’. But he is of the opinion that the premises of an inductive argument cannot by themselves constitute a logically conclusive reason. The fact is that inductive conclusion never contradicts common-sense assertion that they constitute a reason in the ordinary sense of the word. So Russell’s definition of ‘reason’ can be said to be redefinition in the sense that we never use ‘reason’ in ordinary life when we are talking about inductive arguments. But his definition is not a redefinition because in some cases we use reason to mean ‘deductively conclusive reason’.

Edwards again tries to show that the principle of induction is part of the reason because every inductive
conclusion implies always in support of commonsense or empiricism. He says:

For this purpose it is necessary to distinguish two possible senses of any statement of the form ‘All S are P’. Such a statement may either mean ‘All observed S are P’; or it may mean ‘All S whatsoever are P’. He refers the statements of the first category as ‘universal premise’ and the statements of the second category as ‘universal conclusion’. For him:

if the inductive principle were meant as a universal conclusion when forming part of the evidence of inductive conclusions, the charge of petitio principii could be sustained. But it is clear that when it forms part of the evidence of inductive conclusions the inductive principle is or requires to be meant only as a universal premise.
Various attempts have been made by the logicians to solve the problem of induction, which the logicians consider as the problem of the justification of the truth of inductive conclusions. Justification means the justification of a statement. A statement is justified if it has been inferred from other true statements by a procedure, which ensures that they are at least likely to be approximately true. In this regard, I shall refer the view given by Dr. Pranab K. Sen about the general conception of justification. To him,

An inference is justified (or justifiable) if and only if it is possible to sustain the claim which is made in that inference.\(^{22}\)

In order to justify an inference, we must depend upon the claim or the kind of claim, made by any inference of that kind. A valid deductive inference claims that the conclusion must or necessarily follow from the premises. Hence,

A deductive inference is justified if and only if this claim can be sustained.\(^{23}\)

Inversely, a deductive inference cannot be justified if its premises are true but the conclusion is false. But in the case of inductive inference, we cannot claim in the same way. In an inductive inference the truth of the conclusion which is derived from the truth of premises is probable. So,
An inductive inference is justified if and only if this claim could be sustained.\(^2^4\)

If inductive inference cannot guarantee the truth of a conclusion or even, its probability, then it cannot be justified. It is clear that deductive reasoning can justify a conclusion because in deductive reasoning the conclusion must be true if the premises are true. So the truth of the premises guarantees the truth of the conclusion.

It is clear that justification is a rational concept; its meaning varies according to its standard. The justification becomes vacuous where no standard of justification is acceptable. Thus justification of induction depends on its kind of standard.

We have observed that from the very beginning of the philosophy of Bacon, it is one of the important and essential tasks of the philosophers to justify induction. But philosophers have not made it sufficiently clear to themselves as to what sort of justification is required. We find that all philosophers more or less agree that the law of causation is necessary to serve as a premise for an argument by elimination. The underlying assumption of this argument was that induction could be justified only if it was presented as a variety of deductions. All philosophers, however, agree with the fact that the conclusions of deductive argument have superior certainty than that of inductive inference. It is not
possible even in the part of the best induction to draw a certain conclusion from the premises.

Thus we can say that induction cannot be justified from the deductive standard of justification. It is even impossible to justify induction deductively. The reason may be stated by referring to a definition given by, C.S. Peirce. Peirce writes:

Induction is that where we generalise from a number of cases, of which something is true, and infer that the same thing is true of a whole of a class.\textsuperscript{25}

It follows that induction by definition is not a species of deduction and as such it is hopeless to search for a deductive justification of induction.
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