

to the ground, we generalize from *some* known instances. The inductive leap, therefore, consists in passing from the cases which have been observed to all similar cases, embracing the past, the present and the future, the near and the distant, the known and the unknown. Though risky, the inductive leap is essential, and Induction can never be complete without it.

② Secondly, Induction must be based on *observation of facts*. We have seen that material truth or agreement with facts is the aim of Induction, and this aim can be fulfilled only by observation of facts. Thus, for example, the general proposition, "All men are mortal," is based on our observation of particular cases of death of persons we have come across.

③ Thirdly, Induction must be based on *causal connections* among facts. A generalization which is not based on causal connections cannot be accepted as valid. If, for example, the generalization "All crows are black" is based only on some observed cases of black crows, it cannot be regarded as valid. It can be accepted as valid only if a causal connection between "crownness" and "blackness" is proved. Similarly, the generalization, "All red mangoes are sweet," cannot be accepted as a valid induction unless a causal connection between "redness" and "sweetness" of mangoes is shown.

✓ **Comparison of Induction with Deduction**

We may note the following points of difference between Induction and Deduction :—

We have read that in **deductive reasoning**

the premises are always more general than the conclusion. Let us take an example to make this clear.

∴ All men are mortal

A is a man

∴ A is mortal.

Here we start with a general statement about "all men" and proceed to apply it in the case of a particular man. It is quite clear that the conclusion here is less general than the major premise. In Induction our procedure is the other way round. As an example of inductive reasoning, we may take the following :—

A is mortal ; B is mortal ; C is mortal.

∴ All men are mortal.

Here we start with particular instances of mortality, and proceed to prove it to be true in the case of "All men". The conclusion here is clearly more general than the premises. Hence *Deduction and Induction are converse processes*. In Deduction we go from the universal to the particular; from the more general to the less general; while in Induction we go from the particular to the universal, from the less general to the more general. Deduction proceeds from general laws to particular facts, and Induction proceeds from particular facts to general laws. What Deduction begins with, Induction arrives at; and *vice versa*. For Deduction what is true of *all* is true of *each*; for Induction what is true of *each* is true of *all*. This contrast is sometimes expressed by saying that Deduc-

tion descends to particular facts, whereas Induction ascends to general laws.

2 Secondly, Deduction aims at formal truth, while Induction aims at material truth. The business of Deduction is to see whether the conclusion follows necessarily from the premises or not. It is not at all concerned with the material truth of the premises and the conclusion. Given the premises,

All men are flowers,

All tables are men,

Deduction insists that the conclusion "All tables are flowers" must be accepted as true because it necessarily follows from the given premises. But Induction inquires: Is it really true that men are flowers and that tables are men? It challenges the material truth of the premises; that is, it checks them with real facts, and rejects them as false. Thus, Induction guards the "reality principle," the truth of seeing things as they are, and inspects the results, closely examining the criteria of evidence and the warrant of conclusions. In other words, it examines the material validity of the premises by an appeal to actual facts. On the contrary, Deduction takes the premises for granted and simply sees what conclusion can be consistently drawn from them. Deduction is simply concerned with the *Form of Thought* and is, therefore, called *Formal Logic*; Induction is concerned with the *Matter of Thought* and is, therefore, called *Material Logic*. Formal Logic aims merely at the self-consistency of Thought, and Material Logic is concerned with the agreement of Thought with

Reality. The former raises the question : Is this thought consistent with itself? The latter raises the question : Is this thought consistent with actual facts? It is for this reason that one is called the Logic of Consistency, and the other, Logic of Truth or Logic of Science.

③ Thirdly, Induction employs the method of Analysis, while Deduction employs the method of Synthesis. Deduction puts the premises together and sees what it can get out of them taken together. "Syllogism means reckoning all together." Thus, Deduction is mainly synthetic in method. On the contrary the business of Induction is to discover causal connections among facts. In other words, it seeks causes of effects and effects of causes. Causes and effects are, however, found mixed up with irrelevant factors. Induction sorts out the relevant from the irrelevant factors which go with them. In the complex facts, the task of Induction is to separate or eliminate the inessential factors from the essential ones. And this is analysis.

④ → Deduction is based on the *Laws of Thought*, namely, the Law of Identity, the Law of Non-contradiction and the Law of Excluded Middle. Induction, on the other hand, rests on the *Law of Causation* and the *Law of the Uniformity of Nature*. The Law of Causation states that every event or phenomenon has a cause ; and the Law of the Uniformity of Nature states that Nature is uniform, that under similar conditions, the same cause always produces the same effect. Fire *always* produces heat ; water *always* produces

wetness, and so on. We shall discuss these laws in at future chapter.

⑤ Lastly, the results of Deduction are comparatively more certain than those of Induction. In Deduction if the premises are true and the conclusion is drawn according to the rules of Syllogism, the result is absolutely certain. But such a certainty is not to be found in the conclusions of Induction. Perhaps the reason is that the foundations of Deduction are more secure and certain than those of Induction. The Laws of Thought, on which Deduction is based, are Axioms whose certainty is beyond doubt, while the laws of Causation and Uniformity of Nature, on which Induction is based, are Postulates which are simply *assumed to be true*. Besides, Induction, as we have read, involves the inductive leap which is a risky affair.

But in spite of these differences, Deduction and Induction are closely related to each other. Induction supplies universal premises for Deduction, and Deduction verifies the truth of the generalizations of Induction by applying them to fresh particular cases. It is, therefore, wrong to suppose that Induction and Deduction are mutually opposed, that they are like two water-tight compartments. They rather supplement each other in establishing Truth. We may start either from the side of facts or from the side of laws. We may start with facts and try to discover the laws which connect them ; or start with laws and aim at their exemplifications and applications. A doctor, for example, may observe that several patients of malaria are cured by

the use of quinine, and then come to the general law that quinine cures malaria in all cases. Or starting from this general law, he may proceed to verify its truth by applying it to a fresh case of malaria. In the former case, he employs Induction, and in the latter, Deduction. Thus, Induction and Deduction are the two aspects of the same inferential process. When we start with laws and go down to particular facts, we call the inferential process Deduction; and when we start with particular facts and go up to laws, we call the inferential process Induction. And in our reasoning we employ both the processes. It is, therefore, wrong to hold that our reasoning is essentially deductive (as *Hamilton* and other *Formal Logicians* believe) or that it is essentially inductive (as *Mill* and other *Material Logicians* maintain). The correct view is that, for a complete study of Logic, both Induction and Deduction are as equally necessary as the right and the left foot are for walking. The question whether Induction is prior to Deduction (as *Mill* believes) or Deduction is prior to Induction (as *Jevons* believes) is as idle and futile as the question: What comes first?—the Hen or the Egg? As these two are born of each other, so do Induction and Deduction involve each other. Hence the controversy, in past years, over the question of their relative priority has been all useless. Just as Form and Matter cannot be separated from each other, so also the Form of Thought (Deduction) and the Matter of Thought (Induction) cannot be separated. Formless matter and matterless form are unthinkable; Form and Matter must go together. Thus, it follows that

the Science of Logic must embrace both Formal Logic and Material Logic. In order to reach their goal (*i.e.*, the attainment of Truth or Knowledge), *Formal Logic and Material Logic must co-operate like a lame man of good vision and a blind man of sure foot.*

Use and Importance of Induction

Induction, as we have read, enables us to generalize from the observation of some individual instances. It is useful in many ways :—

1. It supplies universal propositions which serve as premises for deductive reasoning. Deduction takes universal premises for granted, and Induction tries to establish their universality.

2. Induction aims at the material truth of the premises which are assumed as true by Deduction. Thus, in the attainment of Truth, in the full sense of the term, Induction is of immense use to deduction.

3. By discovering general laws, Induction opens up the possibility of future inquiry. The discovery of a law becomes a guide for fresh investigation when it is applied to new cases for verification.

4. Lastly, Induction is also useful in the common affairs of our life. In our every-day life, we are continually seeking to explain various happenings, and in doing so we employ, in an elementary form, the methods of Induction. We have read that Induction tries to discover causal connections among facts. Knowledge, says Bacon, is power ;

and no knowledge is more urgently required than the knowledge of *causes*. A student wants to know the *cause* of his failure; a doctor tries to diagnose a disease and discover its *cause*; a magistrate tries to find out the *cause* of a murder. In all such affairs of life, we use inductive methods. Thus, Induction is also of great practical value.

SUMMARY

Need for induction.—Logic is concerned with valid thought. In order to be valid, thought must be free from self-contradiction and must also agree with actual facts; it must be both formally and materially valid. Now, Deduction only sees the formal validity of thought and does not bother about material validity. But formal validity alone is not enough. Hence there is a need for Induction which guarantees the material validity of thought.

Moreover, in all deductive reasoning of the standard form, the major premise is a general or universal proposition which is taken for granted by Deduction. Deduction can prove a universal proposition only by assuming two other universal propositions, and that is no proof. Hence Induction comes to the aid of Deduction and proves universal propositions for it by an appeal to facts.

So Induction is needed first for material validity, and secondly for proving universal propositions. These two purposes for which Induction is required are outside the scope of Deduction.

Essential characteristics of Induction—Induction is the process of inferring universal propositions from particular facts on the evidence of causal connections. It goes from the individual to the general, from the observed to the unobserved, from some to all. The essential characteristics of Induction are :—(1) It establishes a general real proposition; (2) it involves the inductive leap, a going from some to all; (3) it is based on observation of facts; and (4) it is based on causal connections among facts.

Comparison between Induction and Deduction.—The differences between Induction and Deduction are : (1) Induction goes from particular facts to general laws, and Deduction goes from general laws to particular facts; Induction goes from some to all, and Deduction goes from all to some. (2) Induction aims at material validity, and Deduction aims at formal validity; Induction demands that thought should agree with actual reality, and Deduction demands that thought should agree with itself. (3) Induction employs the method of analysis, and Deduction employs the method of synthesis; Induction has to discover causal connections among facts for which analysis (which consists in separating the relevant and the irrelevant factors which go