CHAPTER VIII

UNSCIENTIFIC INDUCTIONS

(SIMPLE ENUMERATION AND ANALOGY)

Perfect and Imperfect Induction

We have read that the business of Induction is to arrive at generalizations, and that a natural way to arrive at generalizations is to examine and enumerate particular instances. Now, enumeration may be "complete" or incomplete." In *complete enumeration*, we examine *all* the instances and then generalize. Thus, after an examination of all the months, we generalize that "All the months of the year have less than thirty-two days." Again, if there are sixty students in my class and each student is examined and found to be unmarried, I am led to make the general statement "All the students of my class are bachelors." Such a complete enumeration, however, is not always possible. We may not be able to go over and exhaust all the instances because some of them may occur in the future or be otherwise out of our reach. In such cases, we generalise after an *incomplete enumeration*, *i.e.*, after an examination of some instances only. To take an example: This crow is black, and that one, up to all that I have seen or heard of; therefore all crows (without exception, *i e.*, those that I have seen and those that I have not seen) are black. Here we go from some cases (*i.e.*, cases hitherto observed) to all cases (without exception). From "every observed instance of a certain class has a certain property" we go to the conclusion "all the members of that class have that property." Clearly, in thus inferring, our conclusion goes beyond the evidence; it is based upon observed instances, but also involves an assertion about what is not observed.

"Complete enumeration" was called *Perfect Induction*, and "incomplete enumeration" was called *Imperfect Induction* by the scholastic logicians. The terms 'Perfect' and 'Imperfect' induction with this distinction, though nearly obsolete in modern times, still continue to exist. Impefect Induction should better be called Unscientific Induction. Unscientific Induction is sub-divided into :—

(*i*) *Simple Enumeration* or *Enumerative Induction*, and

(*ii*) *Analogy*.

I.—Simple Enumeration

Nature and ground of Enumerative Induction

Induction by Simple Enumeration consists in establishing a general proposition on the ground of *mere enumeration* of instances, without an attempt to prove any causal connection. A certain relation is found to exist in several instances, and we argue from its uncontradicted frequency that it is universally prevalent. In other words, we argue that what is true of the examined instances is also true universally. Briefly stated, the argument runs thus: *Because this relation holds good in every* *instance that has been met with, therefore it will continue to hold good in all further instances of the same kind.* For example, we have seen in the past that crow are black. We have never come across a crow of any other colour, nor have we heard that anybody else ever has. On the strength of this *uniform* and *uncontradicted experience*, we arrive at the general proposition—All crows are black. Similarly, we have observed a large number of parrots, and found them to be of green colour; no exception has hitherto been met with; hence we infer "All parrots are green." This leap from "some" to "all" is based on our faith in the uniformity of Nature. Our popular generalizations, such as, All women are tender-hearted,—All schoolboys are mischievous,—All players are intelligent,—All drunkards are adulterers, are the results of Simple Enumeration. Bacon defines this process "as an induction in which we have never found an instance to the contrary." Its formula is: Such and such has always been found to be true; no instance to the contrary has been met with; therefore such and such must always be true.

Because it is a process of counting, therefore its strength depends on the number of *positive* as well as *negative* instances. If the number of positive instances is very large, while there is not even a single negative instance, Induction by Simple Enumeration may acquire a very high degree of probability. Every additional positive instance, along with the presumption that if there had been any instance to the contrary it must have come to the notice of somebody somewhere, strengthens this probability and suggests a question as to whether it is universally certain. To take a simple example from mathematics. We observe in the following series of odd numbers that when they are added together, they give a sum equal to the square of the number of odd numbers in the series.

$1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots = 1^2$

$1+3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots = 2^2$

$1+3+5 \ldots\ldots\ldots\ldots\ldots\ldots = 3^2$

$1+3+5+7 \ldots\ldots\ldots\ldots\ldots = 4^2$

$1+3+5+7+9 \ldots\ldots\ldots\ldots = 5^2$

$1+3+5+7+9+11 \ldots\ldots\ldots = 6^2$

$1+3+5+7+9+11+13 \ldots\ldots = 7^2$

$1+3+5+7+9+11+13+15 \ldots = 8^2$

Each new instance corroborates our observation. Hence from these intances we may generalize and infer the law that the sum of the consecutive odd numbers beginning from 1 is *always* equal to the square of the numbers of terms in the series. This inference is almost *certain* because numerous instances support it, and no exception to it comes to our notice. Geometrical laws which are similarly arrived at (*i.e.*, after an examination of many individual instances) illustrate likewise this form of induction.

Criticism

(1) Mere counting of instances cannot possess any scientific value. "No mere counting of instances, however many they may be, can make a conclusion more certain. We may know that *S*

and *P* are conjoined twice or two thousand or two million times, but this does not warrant us in saying that they are *always conjoined*, unless we have something more than the mere number to go upon" (Mellone). The fact that two things have been found often together does not, by itself, suffice to *prove* that they will be found together in the next case we enamine. The most we can hope is that the oftener things are found together, the more probable it becomes that they will be found together another time, and that if they have been found together often enough, the probability will amount *almost* to certainty. But it can never quite reach certainty, because in spite of frequent repetitions there sumetimes is a failure at the last.

(2) Simple Enumeration can give us only *empirical generalizations*, and not scientific generalizations. It can at best entitle us to say that certain things *hav been and are* so, and not that they *will always* be so. For example, by Simple Enumeration we are justified only in saying that all crows, *so far as we have observed*, are black and not that they will *always* be black.

(3) Simple Enumeration commits the *Fallacy of Non-observation of Instances*. In it, we usually overlook negative instances and note only positive instances, that is, those instances that are relevant to our generalization. While proving that all schoolboys are mischievous, we only count those schoolboys who are mischievous, and avoid noting those who are not. Hence Simple Enumeration is usually precarious and can be overthrown even by a single negative instance. Bacon says: "In-

duction which proceeds by merely citing instances is *res peurilis*, a childish affair, and being without any certain principle or inference, it may be overthrown by a contradictory instance. Moreover, it usually draws a conclusion, taking account only of those instances that are obvious." "A mere *enumeratio simplex*, a mere assemblage of positive instances, is simply worthless." (Mellone.)

(4) Simple Enumeration cannot give us *scientific certainty* because it is not based on causal connections. At best it can give us *probability*. For exmple, we would not be justified in inferring with *perfect certainty* that *all* crows are black even if none but black crows came within our notice.

Value of Induction per Simple Enumeration

1. We should not regard Induction by Simple Enumeration as altogether worthless. It can become pretty nearly certain if we examine a sufficiently large number of instances and also note exceptions or negative instances, if any.

2. Although Simple Enumeration does not *prove* any causal connection, yet it can *suggest* one, and as such it can well claim to be a starting-point of, and a valuable aid to, Induction proper. If we observe a certain uniform connection between two things in a very large number of instances, naturally the presumption arises that there may be a causal connection between those two things. This presumption goes on becoming stronger and stronger as the number of instances goes on increasings, and it may attain a very high degree of probability in the case of pre-

ponderance of evidence. "The chief value of the enumerative method lies in its power to *suggest* a causal connection. The consideration that two phenomena are always or very frequently connected seems sufficient ground for entertaining the hypothesis that they are causally related. Inductive Enumeration, then, is not altogether worthless from a scientific point of view; it is at least a valuable aid to Induction proper." (Grumley.)

3. Simple Enumeration stimulates and guides future inquiry. As Mellone says: "The very fact that *S* and *P* are found to be conjoined in so many cases forcibly suggests an examination of the cases to see if they agree in any other material circumstances. If they do not, then a real connection of *S* and *P* is suggested for further examination and testing."

4. On Simple Enumeration is based the Statistical method which is employed by Statistics, Economics, Mathematics and Sociological Sciences. Banks and Insurance Companies, for example, base their calculations on nothing but the counting of instances.

5. Simple Enumeration is of great practical importance in our common life. Our everyday generalizations and popular sayings are the result of Simple Enumeration.

6. Simple Enumeration possesses one important characteristic of Scientific Induction, namely, the *Inductive Leap*. It goes from 'some' to 'all', from the known to the unknown, and is at least better than Perfect Induction in this respect.

Nature and Ground of Analogy

II.—Analogy

The word 'Analogy' comes from the Greek word '*analogia*' which was used by Aristotle to mean *equality of ratios*, corresponding to what is known as '*proportion*' in arithmetic. For example, 2 : 4 : : 3 : 6 ; the parents are to their children as the government is to its subjects ; the camel is to the desert as the ship is to the sea ; the principal is to the staff as the captain is to the team. Originally, then, the term 'Analogy' was accepted in the sense of equality of ratios or relations. But in the modern sense, Analogy means an inference based not only on a resemblance of relations but on *any resemblance* or *similarity* between two things. Thus, argument from Analogy now means an argument from some degree of resemblance to a further resemblance. "In Analogy we reason from likeness in many points to likeness in other points" (Jevons). In other words, it is a kind of reasoning in which we argue that things alike in some respects are also alike in other respects. If two things resemble each other in certain points, we may infer that they resemble in other points as well, though no causal connection is established between the already existing points of resemblance and the inferred point of resemblance. Hence Analogy is simply an argument from resemblance, and not from causal connections. According to Mill, its formula is : "Two things resemble each other in one or more respects ; a certain proposition is true of the one ; therefore it is true of the other."

Symbolically, the form of the argument can be represented thus :

A resembles *B* in certain properties, *X*, *Y*, *Z*,
B possesses a further pryperty *P*
∴ *A* also possesses the property *P*.

Examples

1. "We may observe a very great similitude between this earth which we inhabit and the other planets. They all revolve round the sun, as the earth does. They borrow all their light from the sun, as the earth does. Several of them are known to revolve round their axis like the earth, and by that means have like succession of day and night. Some of them have moons, that serve to give them light in the absence of the sun, as our moon does to us. They are all, in their motions, subject to the same law of gravitation as the earth is. From all this similitude it is not unreasonable to think that these planets may, like our earth, be the habitation of various creatures" (Thomas Reid).

2. A servant performs his duties like a clock. Now, just as a clock is not thrown away if it goes wrong, so also a servant should not be put out of service if he makes mistakes.

3. Associations like joint-stock companies are best managed by a committee chosen from among the shareholders themselves. Similarly, the best form of national government is by a popularly elected assembly.

4. Pakistan is a country like England, and if a

democratic form of government has been successful in England, it must also be successful in Pakistan.

5. The state is like a family, and if paternal government works very well in the family, so should the despotic government in the state.

Obviously, the ground in all these analogical arguments is the assumption that things similar in one respect will also be similar in another respect. Because this assumption is not based on any causal connection between the common points of the two objects compared, it can at the most possess probability, but not certainty.

How to estimate the strength of Analogy ?

An argument from Analogy may be strong or weak. The strength of an analogical argument depends upon the strength of the points of resemblance on which it is based. Mill is of opinion that if the resemblance is very great, while the difference very small, and our knowledge of the subject-matter sufficiently extensive, the argument from Analogy may approach in strength very near to a valid induction. He says that if *A* agrees with *B* in nine out of ten points, there is a probability of nine to one that it will also possess the additional property *P* which is found in *B*. Mill is wrong here in saying that the strength of Analogy depends *merely* upon the *number* of the points of resemblance and difference, or the *amount* of similarity and dissimilarity. The truth is that the force of an analogical argument depends not so much upon the *number* as upon the *nature* or *importance* of the points of resemblance and difference; not so much upon the *quantity* as upon the *quality* of the resemblance and the difference. If the points of resemblance are many in number but are superficial and unimportant, the argument carries little or no conviction. But if the points of resemblance are numerous as well as *essential* or *important*, while the points of difference are very few as well as unimportant, and the number of the unknown points in the objects compared s extremely small, an argument from Analogy may be of considerable cogency or force. It may be mentioned here that "essential" and "important" are relative terms. A point may be important for one purpose, but unimportant for another. In our example No. 1, all the points of similarity which are shown to exist between the earth and the other planets, though important for other purposes, are unimportant for deciding the point of habitability. Thus, "essential" means *relevant for the purpose in view*, or *having a bearing on the inference.*

If in an analogical argument, a superficial point of resemblance is seized upon and made the basis of inference, while the important points of difference are ignored, our argument will be weak and even misleading. Even one important point of difference may be enough to set aside many unimportant points of resemblance. Suppose, for example, that two persons *A* and *B* resemble in many points, but differ only in one, namely that *A* has eyes while *B* is blind. Now, if *A* is a regular picture-goer, we cannot infer on the basis of their many resemblances that *B* also possesses this characteristic, because one material point of difference here, *i.e.*, blindness, is sufficient to overthrow their many points of resemblance and settle the matter in question. Similarly, in our example No. 2, one important difference, namely, that a clock is a machine whereas a servant is a conscious being, is ignored in deciding the question of dispensing with them when they go wrong.

Hence, we may say that in analogical arguments we should not simply *count* the points of resemblance and difference but should also *weigh* them. As Sidgwick says : " Whenever ' degree ' or ' amount' of resemblance or difference is spoken of, the student must remember that, for all purposes of reasoning, a resemblance or difference is great or small, not according either to its power of striking the observer's notice, or to the *number* of ' points ' (or details) ; but according to the *importance* of its details in regard to the *matter in hand*."

To sum up : we may lay down the following general rules to estimate the strength or probability of analogy :—

1. Probability increases with the number and importance of the points of similarity. If two teachers resemble each other in their academic qualifications, studiousness, facility of expression, sense of duty, etc., and if one is an efficient teacher, there will be a great probability that the other will also be so.

2. Probability decreases with the number

and importance of the points of difference. If two mangoes differ in colour, smell and shape, and if one is sweet, the probability of the other being so is very weak.

3. Probability decreases with the number of the unknown points in the things compared. If the United States of America and England are known to resemble only in one point, namely, that both are English-speaking countries, while many other points about the two countries remain unknown, then the argument that because the Law of Prohibition is passed in the U. S. A., therefore it should also be passed in England, will have very little force.

Thus, the probability of Analogy is measured by ascertaining

(1) *the number and importance of the points of resemblance,*

(2) *the number and importance of the points of difference, and*

(3) *the number of the unknown points.*

Mathematically, this may be expressed as :—

$$\textit{Probability of analogy} = \frac{\textit{Resemblances}}{\textit{Differences} + \textit{Unknown points}}.$$

The probability of Analogy is greater if the numerator is greater than the denominator than if the denominator is greater than the numerator.

Criticism

Though mathematically expressed, this rule is really far from possessing any exactness. The following difficulties arise when we try to work out this so-called 'ratio' in actual practice.

1. The points of resemblance and difference cannot be counted like cards and coins. It is often hard to decide whether a given point is one or many. We *arbitrarily* count each point as one which is not always the case. If, for example, two persons are found to resemble each other in literary taste, we can neither accept their literary tastes as strictly analogous nor count them as numerical *units*. Hence there cannot be a ratio in Analogy because we can speak of a ratio only in connection with numerical units, and nothing like numerical units can be attained in Analogy.

2. It is meaningless to speak of the number of the unknown points because we do not know how many they are. What is unknown cannot enter into our calculation ; and if it is does, our calculation becomes a farce.

Kinds of Argument from Analogy

Analogical arguments may assume the following forms :—

1. Argument a pari

If an argument is based on a parity (or equality) of ratios or relations, it is called " Argument a pari." For example, as the children are to their parents, so are the subjects to their government ; hence as children must obey their parents, so must the subjects obey their government.

2. Argument per exemplum

It is an argument from *example*. It consists in proving something to be true in one particular case from another particular case. For example, we may argue that England has adopted a democratic franchise, therefore Pakistan may also adopt it. Such arguments are the stock-in-trade of the popular politician. Hence Aristotle calls them "*oratorical induction.*"

3. Argument per contra

It consists in arguing from opposite conditions. For example, we may argue that diligence leads to success, therefore indolence leads to failure ; heat expands bodies, therefore cold contracts them.

4. Argument a fortiori

It consists in inferring an increase of a certain thing or quality from an increase in similar things or qualities. Examples : If rich persons are affected by high prices, the more so are the poor. If good students must work hard, then those who are weak must work harder still. England, whose industries are safe from foreign competition, is justified in adopting a policy of Protection, the justification of Pakistan, whose industries are already weak, is greater still.

True and false Analogy

A true analogy means an argument which fulfils all the *conditions* mentioned above ; that is, which is based upon a sound, careful and comprehensive comparison of the points of resemblance and difference. A false analogy is one which is based upon a superficial, hasty and narrow estimate of the points of resemblance and difference. Actually, however, Analogy is more often false than true. Minto has rightly said that the degree of probability in Analogy is " much nearer zero than certainty." The falsity of Analogy may be due to—

(*a*) our failure to observe important points of difference,

(*b*) our picking up superficial points of resemblance, and

(*c*) our use of far-fetched similes or metaphors.

(*a*) If we argue that just as the serpent casts its skin annually, so our Assemblies and Parliaments should be annually overhauled, the argument will be a false analogy because we have failed to observe the points of difference between the serpent and human legislatures. Here is this argument.

"Wisest of beasts the serpent see.
Just emblem of eternity.
And of a State's duration ;
Each year an annual skin he takes.
And with fresh life and vigour wakes
At every renovation.
Britain ! that serpent imitate ;
Thy Commons House, that skin of State.
By annual choice restore ;
So choosing thou shall live secure,
And freedom to thy sons insure ;
Till Time shall be no more.

(*b*) Again, if we argue that men and animals resemble in the attribute of animality, therefore animals can also distinguish between good and evil as men can, our argument will be a false analogy because it is based upon a superficial point of similarity. A common tendency of naming a child after a great personality in the hope that it will be similarly great, illustrates False Analogy. Fallacious analogical inferences have played a great part in the formation of many illusory beliefs in the primitive man. He believed that if the image of a man be damaged, the man himself will be harmed. We can find traces of such superstitious beliefs even today among illiterate folk.

(*c*) The use of metaphorical language is a frequent source of false analogical inferences. Examples: Education is a ladder, hence it helps us in attaining heights. Logic is the medicine of mind, hence it cures mental diseases. A newly started industry is an infant industry, therefore it should be protected like an infant. A college is an *alma mater*, hence it provides nourishment like the mother. In all these arguments, we find that the use of metaphorical language leads to False Analogy. A metaphor may become easily misleading, if taken as a literal description of the facts.

So long as we use a metaphor simply as an illustrative picture, there is no harm. But if we carry it too far, *i.e.*, make an unwarrantable extension of our metaphorical illustration, an extension that would be fraught with misleading associations, we are led to a false inference.

The usefulness of Analogy.

It is evident that Analogy is essentially weak for the purpose of argument. It is, nevertheless, a useful source of investigation. Its value as a method of *proof* is very little, but its usefulness as a means of *discovery* is very great, especially if it is based on real similarity. For example, the similarity between Californian hills and Australian hills near Ballarat *suggested* that if gold was found in the former, it should also be found in the latter; and actually gold was discovered in Australian hills. Many important discoveries are similarly made in medicine, mining, and other spheres of life. Thus, Analogy is very useful in suggesting a line of inquiry. In the words of Mill, it is "a guide-post, pointing out the direction in which more rigorous investigation should be prosecuted." Hence it can be of great service to scientific induction. "In relation to a complete scientific inquiry, its logical function is heuristic. It plays an important part in the Logic of Discovery" (Gibson).

Furthermore, Analogy by making comparisons between things facilitates our understanding of them. For example, we speak of a sweet tune, a sweet flower, a sweet face, a sweet poem. All these things are called "sweet" on account of a peculiar pleasure which they yield and which cannot be understood otherwise than by an analogy with sweetness. Similarly, we describe a pain as sharp, a career as brilliant, a disappointment as bitter, a temper as sour, a despair as gloomy, and so on. All such adjectives and expressions which help us in understanding things imply analogy. If you select any short passage from a book on any subject, you would easily recognize how numerous are the analogies we use and how indispensable they are. Expressions like "weighing an evidence", "going to the root of a problem", "falling into mistakes", "coining a new phrase", etc , may be taken as examples. Thus, analogy is very valuable as an instrument of explanation.

Analogy and Scientific Induction

Both Analogy and Scientific Induction are based on observation and comparison of facts. Though Analogy does not *prove* a causal connection, it suggests one, and is, therefore, a stage on the road to Scientific Induction. It differs from Scientific Induction in the following points :—

1. Analogy is not based on causal connections, while Scientific Induction is based on causal connections.

2. Analogy can be at the most probable, while Scientific Induction is comparatively certain. This is so because the conclusions of Scientific Induction are based on causal connections, but the conclusions of Analogy are not.

3. Scientific Induction goes from individual instances to generalizations, while Analogy goes from one individual instance to another individual instance. Thus, while Scientific Induction proceeds from the particular to the universal, Analogy proceeds from the particular to the particular. Hence Analogy lacks one fundamental essential of Scientific Induction, namely, the Inductive Leap. Its

principle is : If one thing agrees with another in many respects, it will agree in some other respect as well. The *principle* of Scientific Induction is: If something is true of many individuals, it must be true of the whole class of those individuals. Scientific Induction reasons from something in many to something in all, but Analogy reasons from something in two to something more in two.

4. Scientific Induction goes from some instances to all instances. Thus, it is concerned with *instances* and therefore its procedure is by way of denotation. Analogy is concerned with resemblances or *attributes* ; hence its procedure is by way of connotation.

5. Analogy is not so analytic as Scientific Induction. Scientific Induction employs thorough comparison and analysis before arriving at generalizations. Analogy employs but incomplete analysis.

Analogy and Simple Enumeration.

Both Analogy and Simple Enumeration are Imperfect Inductions. Both are only probable and are alike in not being based on causal connections. Though essentially weak, yet both are valuable accessories of Scientific Induction. They, however, differ in the following points :—

1. Analogy is based on the number of the points of similarity and difference, while Simple Enumeration is based on the number of Instances.

2. Analogy deals with the connotation of things, while Simple Enumeration deals with the denotation of things. Both are essentially processes

of counting, but one counts *instances* and the other attributes.

3. Analogy goes from the particular to the particular, while Simple Enumeration goes from the particular to the general. In this respect, therefore, Simple Enumeration is better than Analogy.

4. In Analogy we *compare* and count the points of similarity and difference. In Simple Enumeration we only count instances. Thus, Analogy is a process of *comparison as well as counting*, while Simple Enumeration is only a process of *counting*. Thus, Analogy goes deeper than Simple Enumeration in so far as it analyses the two things that it compares; it is more *analytic* than Simple Enumeration.

SUMMARY

If we examine *all* the instances and then generalize, we have what is called Perfect Induction. So Perfect Induction is nothing but "complete enumeration." But when we generalize after an incomplete enumeration, that is, after an examination of some instances only, we have what is called Imperfect Induction. Under Imperfect Induction are included Simple Enumeration and Analogy.

Simple Enumeration, also called Enumerative Induction, consists in establishing a general proposition on the ground of mere enumeration of instances, without an attempt to prove any causal connection. If we have seen only green parrots and our experience is not contradicted by any instance to the contrary we shall generalize and say that all parrots are green. Thus, Simple Enumeration is based on uniform and uncontradicted experience. Because it is a process of counting, its strength depends on the number of instances. If the number of positive instances is very large, while there is not even a single negative instance, Induction by Simple Enumeration may acquire a very high degree of probability.

The following objections have, however, been raised against Simple Enumeration : (1) Mere counting of instances cannot possess any scientific value. We must have something more than the mere number to go upon. (2) Simple Enumeration can give us only empirical generalizations and not scientific generalizations. For example, by Simple Enumeration we are justified only in saying that all crows, so far as our experience goes, are black, and not that they will always be necessarily black. (3) Simple Enumeration generally commits the fallacy of non-observation of instances. In it we usually overlook negative instances and note only positive instances—that is, those instances that are relevant to our generalization. (4) Because Simple Enumeration is not based on causal connections, it cannot give us scientific certainty. At best it can give us probability.

In spite of the above defects, Simple Enumeration does possess some value and is not altogether worthless. (1) It can become very nearly certain if we examine a sufficiently large number of instances and also note exceptions or negative instances, if any. (2) Although it cannot *prove* any causal connection, yet it can *suggest* a causal connection. When we observe a certain uniform connection between two things in a very large number of instances, naturally the presumption arises that there may be a causal connection between those things. (3) Simple Enumeration stimulates and guides future inquiry. (4) On Simple Enumeration is based the statistical method. Banks and insurance companies, for example, base their calculations on nothing but the counting of instances. (5) Our everyday generalizations and popular sayings are also the results of Simple Enumeration. (6) Simple Enumeration possesses one important characteristic of Scientific Induction, namely, the Inductive Leap, and is better than Perfect Induction in this respect at least.

Analogy.—Aristotle used the word "analogy" in the sense of equality of ratios or relations : *e.g.*, 2 : 4 : : 3 : 6 ; the parents are to their children as the government is to its subjects. In the modern sense, analogy means an argument based on any resemblance between two things The formula of analogy is that things alike in some respects are also alike in other respects. It would be an argument from analogy to say that because two persons resemble each other in age, religion and financial conditions, therefore if one is a drunkard the other must also be a drunkard. Thus, in analogy we reason that, if two things resemble each other in certain points, they will resemble in other points as well. As analogy is not based on any causal connection among the common points of the two things compared, it can at best possess probability, and not certainty. The strength of an analogical argument depends on the number and strength of the points of resemblance, the number and strength of the points of difference, and the number of unknown points. Mill says that if A agrees with B in nine out of ten points, then there is a probability of nine to one that it will also possess the additional property which is found in B. Mill is wrong in saying this because we have not only to *count* the points of resemblance and difference but have also to *weigh* them. The strength of analogy does not depend merely on the number but also on the importance of the points of resemblance and difference. Mathematically, this may be expressed as follows :

$$\text{Strength of Analogy} = \frac{\text{Resemblances}}{\text{Differences} + \text{Unknown Points.}}$$

There are, however, some difficulties in trying to work out this equation. First, the points of resemblance and difference cannot be counted like cards and coins. It is often hard to decide whether a point is one or many. Secondly, about the unknown points we do not know as to how many they are.. What is unknown cannot enter into a calculation. Nevertheless, we can say that if the points of resemblance are many and important, and the points of difference are few and unimportant, and the unknown points are very few, an argument from analogy may approach very near to certainty.

But all these conditions are seldom fulfilled, and an argument from analogy is generally a false analogy. We have a false analogy when we overlook differences which are important, or when we pick up superficial (unimportant) points of resemblance, or when we use far-fetched metaphors and carry them too far. It would be a false analogy to argue that just as the serpent casts its skin annually, so our Assemblies should be annually overhauled. A true analogy is an argument which is based on a sound, careful and comprehensive comparison of the points of resemblance and difference. Actually, however, analogy is more often false than true.

The usefulness of Analogy.—Analogy is a useful source of investigation. Its value as a means of discovery is very great. For example, the similarity between Californian hills and Australian hills near Ballarat suggested that if gold was found in the former, it must be found in the latter too ; and this actually came out to be true.

Secondly, analogy by making comparisons between things facilitates our understanding of them. For example, we speak of a sweet tune, a sweet face, a sweet poem. We call all these things sweet on account of a peculiar pleasure which they give and which cannot be understood otherwise than by an analogy with sweetness.

Analogy and Scientific Induction.—Both are based on observation and comparison of facts, but they also differ in the following points : (1) Analogy is not based on causal connections, while Scientific Induction is based on causal connections. (2) Analogy can at best possess probability, but Scientific Induction possesses certainty. (3) Analogy goes from the particular to the particular, but Scientific Induction goes from the particular to the universal (4) Analogy is concerned with attributes and therefore its procedure is by way of connotation, but Scientific Induction is concerned with instances and therefore its procedure is by way of denotation. (5) Analogy is not so analytic as Scientific Induction. Analogy does employ analysis but not so thoroughly as Scientific Inductio .

Analogy and Simple Enumeration.—Both are Imperfect Inductions ; both are probable, and both lack causal connections. They differ from each other in the following points : (1) Analogy is concerned with attributes, but Simple Enumeration is concerned with instances. (2) Analogy goes from the particular to the particular, but Simple Enumeration goes from the particular to the general. In this respect, Simple Enumeration is better than Analogy. (3) Analogy is a process of comparison as well as counting, but Simple Enumeration is only a process of counting. Analogy is more analytic, and is therefore in this respect better than Simple Enumeration.

QUESTIONS

1. Write a brief explanatory note on False Analogy.

2. Explain carefully the nature of analogical inference. What are the weak points in an argument from Analogy? Illustrate your answer by an example.

3. What is the nature of the argument from Analogy? Can it ever be regarded as conclusive? What are the conditions on which the strength of such argument depends?

4. Indicate with examples the distinction between Perfect Induction and Simple Enumeration. Discuss the value of a conclusion reached by Simple Enumeration. Show how this method of reasoning depends on the Uniformity of Nature.

5. Distinguish between Argument from Analogy and Induction by Simple Enumeration. Which of these comes nearer to Scientific Induction and why?

6. What do you understand by induction by simple enumeration? Show its weakness and its value in comparison with scientific induction.

7, 8. What is meant by Reasoning from Analogy? What are the general conditions on which the accuracy of this argument depends?