CHAPTER XVII

Combination of Induction with Induction

Section 1. We have now reviewed Mill's five Canons of Inductive Proof. At bottom, as he observes, there are only two, namely, Agreement and Difference: since the Double Method, Variations and Residues are only special forms of the other two. Indeed, in their function of proof, they are all reducible to one, namely, Difference; for the cogency of the method of Agreement (as distinguished from a simple enumeration of instances agreeing in the coincidence of a supposed cause and its effect), depends upon the omission, in one instance after another, of all other circumstances; which omission is a point of difference.

The Canons are an analysis of the conditions of proving directly (where possible), by means of observation or experiment, any proposition that predicates causation. But if we say 'by means of observation or experiment,' it is not to be understood that these are the only means and that nothing else is involved; for it has been shown that the Law of Causation is itself an indispensable foundation of the evidence. In fact Inductive Logic may be considered as having a purely formal character. It consists (1) in a statement of the Law of Cause and Effect; (2) in certain immediate inferences from this Law, expanded into the Canons; (3) in the syllogistic application of the Canons to special predications of causation by means of minor premises, showing that certain instances satisfy the Canons.

At the risk of some pedantry, we may exhibit the process as follows (cf. Prof. Ray's Logic: Appendix D):

Whatever relation of events has certain marks is a case of causation;

The relation A: p has some or all of these marks (as shown by observation and by the conformity of instances to such or such a Canon):

Therefore, the relation A: p is a case of causation. Now, the parenthesis, “as shown by the conformity, etc.,” is an adscititious member of an Epicheirema, which may be stated, as a Prosyllogism, thus:

If an instance, etc. (Canon of Difference);

The instances

A B C	B C
p q r′	q r

are of the kind required:

Therefore, A, present where p occurs and absent where it does not occur, is an indispensable antecedent of p.

Such is the bare Logic of Induction: so that, strictly speaking, observation or experiment is no part of the logic, but a means of applying the logic to actual, that is, not merely symbolical, propositions. The Formal Logic of Induction is essentially deductive; and it has been much questioned whether any transition from the formal to the material conditions of proof is possible. As long as we are content to illustrate the Canons with symbols, such as A and p, all goes well; but can we in any actual investigation show that the relevant facts or ‘instances’ correspond with those symbols?

In the first place, as Dr. Venn shows, natural phenomena want the distinctness and capability of isolation that belong to symbols. Secondly, the observing whether instances conform to a Canon, must always be subject at last to the limits of our faculties. How can we ascertain exact equality, immediate sequence? The Canon of Difference, in its experimental application, is usually considered the most cogent sort of proof: yet when can the two sequent instances, before and after the introduction of a certain agent, be said to differ in nothing else? Are not earth and stars always changing position; is not every molecule in the room and apparatus always oscillating? It is true that our senses are now aided by

elaborate instruments; but the construction of these depends on scientific theories, which again depend on experiments.

It is right to touch upon this well-known sceptical topic; but to insist much upon it is not a sign of good sense. The works of Herschel, Whewell, and Jevons should be consulted for the various methods of correcting observations, by repeating them, averaging them, verifying one experimental process by another, always refining the methods of exact measurement, multiplying the opportunities of error (that if any exist it may at last show itself), and by other devices of what may be called Material Logic or Methodology. But only direct experience and personal manipulation of scientific processes, can give a just sense of their effectiveness; and to stand by, suggesting academic doubts, is easier and more amusing.

Section 2. Still, it is not so much in laws based upon direct observation or experiment, that the material validity of scientific reasoning appears, as in the cumulative evidence that arises from the co-ordination of laws within each science, and the growing harmony and coherence of all sciences. This requires a more elaborate combination of deduction with observation and experiment. During the last three hundred years many departments of science have been reduced under principles of the greatest generality, such as the Conservation of Energy, the Law of Gravitation, the Undulatory theory of Light, the Law of combining Equivalents, and the Theory of Natural Selection; connecting and explaining the less general laws, which, again, are said to connect and explain the facts. Meanwhile, those sciences that were the first to make progress have helped to develop others which, like Biology and Sociology, present greater difficulties; and it becomes more and more apparent that the distinctions drawn among sciences are entirely for the convenience of study, and that all sciences tend to merge in one universal Science of Nature. Now, this process of the ‘unification of knowledge’ is almost another name for deduction; but at the same time it depends for its reality and solidity upon a constant reference to observation and experiment. Only a very inadequate notion of it can be given in the ensuing chapters.

We saw in chap. xiv. Section 6, that when two or more agents or forces combine to produce a phenomenon, their effects are intermixed in it, and this in one of two ways according to their nature. In chemical action and in vegetable and animal life, the causal agents concerned are blended in their results in such a way that most of the qualities which they exhibited severally are lost, whilst new qualities appear instead. Thus chlorine (a greenish-yellow gas) and sodium (a metal) unite to form common salt NaCl; which is quite unlike either of them: a man eats bread, and it becomes muscle, nerve and bone. In such cases we cannot trace the qualities of the causal agents in the qualities of the effects; given such causes, we can prove experimentally, according to the canons of induction, that they have such effects; but we may not be able in any new case to calculate what the effects will be.

On the other hand, in Astronomy and Physics, the causes treated of are mechanical; at least, it is the aim of Physics to attain to a mechanical conception of phenomena; so that, in every new combination of forces, the intermixed effect, or resultant, may be calculated beforehand; provided that the forces concerned admit of being quantitatively estimated, and that the conditions of their combination are not so complex as to baffle the powers of mathematicians. In such cases, when direct observation or experiment is insufficient to resolve an effect into the laws of its conditions, the general method is to calculate what may be expected from a combination of its conditions, as either known or hypothetically assumed, and to compare this anticipation with the actual phenomenon.

Section 3. This is what Mill calls the Direct Deductive Method; or, the Physical Method, because it is so much relied on in treating of Light, Heat, Sound, etc.; it is also the method of Astronomy and much used in Economics: Deduction leads the way, and its results are tested inductively by experiments or observations. Given any complex mechanical phenomenon, the inquirer considers–(1) what laws already ascertained seem likely to apply to it (in default of known laws, hypotheses are substituted: cf. chap. xviii.); he then–(2) computes the effect that will follow from these laws in circumstances similar to the case before him; and (3) he verifies his conclusion by comparing it with the actual phenomenon.

A simple example of this method is the explanation of the rise of water in the 'common pump.' We know three laws applicable to this case: (a) that the atmosphere weighs upon the water outside the pump with a pressure of 15 lb. to the square inch; (b) that a liquid (and therefore the water) transmits pressure equally in all directions (upwards as well as downwards and sideways); and© that pressure upon a body in any direction, if not counteracted by an opposite pressure, produces motion. Hence, when the rise of the piston of the pump removes the pressure upon the water within the cylinder, tending to produce a vacuum there, this water is pushed up by the pressure of the air upon the water outside the cylinder, and follows the rising piston, until the column of water inside the cylinder exerts a pressure equal to that of the atmosphere upon an equal area. So much for the computation; does it correspond with the fact? It is found that at the sea level water can be pumped to the height of 33 ft; and that such a column of water has a pressure of 15 lb. to the square inch. We may show further that, at the sea level, spirits of wine may be pumped higher according to its less specific gravity; and that if we attempt to pump water at successive altitudes above the sea level, we can only raise it to less and less heights, corresponding with the lessened atmospheric pressure at those altitudes, where the column of air producing the pressure is shorter. Finally, if we try to work a pump, having first produced a vacuum over the water outside the cylinder, we shall find that the water inside will not rise at all; the piston can be raised, but the water does not follow it. The verification thus shows that the computed effect corresponds with the phenomenon to be explained; that the result does not depend upon the nature of water only, but is true (allowing for differences of specific gravity) of other liquids; that if the pressure of the outside air is diminished, the height of pumping is so too (canon of Variations); and that if that pressure is entirely removed, pumping becomes impossible (canon of Difference).

Any text-book of Astronomy or Physics furnishes numerous illustrations of the deductive method. Take, for example, the first chapter of Deschanel's Optics, where are given three methods of determining the velocity of Light. This was first deduced from observation of Jupiter's satellites. The one nearest the planet passes behind it, or into its shadow, and is eclipsed, at intervals of about

42_ hours. But it can be shown that, when Jupiter and the Earth are nearest together on the same side of the Sun, an eclipse of this satellite is visible from the earth 16 min. 26.6 sec. earlier than when Jupiter and the earth are furthest apart on opposite sides of the Sun: 16 min. 26.6 sec, then, is the time in which light traverses the diameter of the Earth's orbit. Therefore, supposing the Earth's distance from the Sun to be 92 millions of miles, light travels about 186,000 miles a second. Another deduction, agreeing with this, starts from the fact of aberration, or the displacement of the apparent from the actual position of the stars in the direction of the earth's motion. Aberration depends partly on the velocity of light, partly on the velocity of the Earth; and the latter being known, the former can be computed. Now, these two deductive arguments, verifying each other, have also been verified experimentally. Foucault's experiment to measure the velocity of light is too elaborate to be described here: a full account of it will be found in the treatise above cited, Section 687.

When the phenomena to be explained are of such a character, so vast in extent, power or duration, that it is impossible, in the actual circumstances of the case, to frame experiments in order to verify a deductive explanation, it may still be possible to reproduce a similar phenomenon upon a smaller scale. Thus Monge's explanation of mirage by the great heat of the desert sand, which makes the lowest stratum of air less dense than those above it, so that rays of light from distant objects are refracted in descending, until they are actually turned upwards again to the eye of the beholders, giving him inverted images of the objects as if they were reflected in water, is manifestly incapable of being verified by experiment in the natural conditions of the phenomenon. But by heating the bottom of "a sheet-iron box, with its ends cut away," the rarefied air at the bottom of the box may sometimes be made to yield reflections; and this shows at least that the supposed cause is a possible one (Deschanel, Optics, Section 726). Similarly as to the vastest of all phenomena, the evolution of the stellar system, and of the solar system as part of it, from an immense cloudlike volume of matter: H. Spencer, in his Essay on The Nebular Hypothesis, says, amidst a great array of deductive arguments from mechanical principles, that "this a priori reasoning harmonises with the results of experiment. Dr. Plateau has shown that when a mass of fluid is,

as far as may be, protected from the action of external forces, it will, if made to rotate with adequate velocity, form detached rings; and that these rings will break up into spheroids, which turn on their axes in the same direction with the central mass." The theory of the evolution of species of plants and animals by Natural Selection, again, though, of course, it cannot be verified by direct experiment (since experiment implies artificial arrangement), and the process is too slow for observation, is, nevertheless, to some extent confirmed by the practice of gardeners and breeders of animals: since, by taking advantage of accidental variations of form and colour in the plants or animals under their care, and relying on the inheritability of these variations they obtain extensive modifications of the original stocks, and adapt them to the various purposes for which flowers and cereals, poultry, dogs and cattle are domesticated. This shows, at least, that living forms are plastic, and extensively modifiable in a comparatively short time.

Section 4. Suppose, however, that, in verifying a deductive argument, the effect as computed from the laws of the causes assigned, does not correspond with the facts observed: there must then be an error somewhere. If the fact has been accurately observed, the error must lie either in the process of deduction and computation, or else in the premises. As to the process of deduction, it may be very simple and easily revised, as in the above explanation of the common pump; or it may be very involved and comprise long trains of mathematical calculation. If, however, on re-examining the computations, we find them correct, it remains to look for some mistake in the premises.

(1) We may not have accurately ascertained the laws, or the modes of operation, or the amounts of the forces present. Thus, the rate at which bodies fall was formerly believed to vary in proportion to their relative weights; and any estimate based upon this belief cannot agree with the facts. Again, the corpuscular theory of light, namely, that the physical cause of light is a stream of fine particles projected in straight lines from the luminous object, though it seemed adequate to the explanation of many optical phenomena, could not be made to agree with the facts of interference and double refraction.

(2) The circumstances in which the agents are combined may not have been correctly conceived. When Newton began to inquire whether the attraction of the earth determined the orbit of the moon, he was at first disappointed. "According to Newton's calculations, made at this time," says Whewell, "the moon, by her motion in her orbit, was deflected from the tangent every minute through a space of thirteen feet. But by noticing the space which bodies would fall in one minute at the earth's surface, and supposing this to be diminished in the ratio of the inverse square, it appeared that gravity would, at the moon's orbit, draw a body through more than fifteen feet." In view of this discrepancy he gave up the inquiry for sixteen years, until in 1682, having obtained better data, he successfully renewed it. "He had been mistaken in the magnitude of the earth, and consequently in the distance of the moon, which is determined by measurements of which the earth's radius is the base." It was not, therefore, a mistake as to the law or as to the nature of the forces concerned (namely, the law of the inverse square and the identity of celestial with terrestrial gravity), but as to the circumstances in which the agents (earth and moon) were combined, that prevented his calculations being verified. (Hist. Ind. Sc.: VII. ii. 3.)

(3) One or more of the agents affecting the result may have been overlooked and omitted from the estimate. Thus, an attempt to explain the tides by taking account only of the earth and the moon, will not entirely agree with the facts, since the sun also influences the tides. This illustration, however, shows that when the conclusion of a deductive explanation does not entirely agree with the facts, it is not always to be inferred that the reasoning is, properly speaking, wrong; it may be right as far as it goes, and merely inadequate. Hence (a) in such cases an opportunity occurs of applying the Method of Residues, by discovering the agent that must be allowed for in order to complete the explanation. And (b) the investigation of a phenomenon is often designedly begun upon an imperfect basis for the sake of simplicity; the result being regarded as a first approximation, to be afterwards corrected by including, one by one, the remaining agents or circumstances affecting the phenomenon, until the theory is complete; that is, until its agreement with the facts is satisfactory.

(4) We may have included among the data of our reasonings agents or circumstances that do not exist or do not affect the phenomenon in question. In the early days of science purely fanciful powers were much relied upon: such as the solid spheres that carried the planets and stars; the influence of the planets upon human destiny; the tendency of everything to seek "its own place," so that fire rises to heaven, and solids fall to the earth; the "plastic virtue" of the soil, which was once thought to have produced fossils. When, however, such conceptions hindered the progress of explanation, it was not so much by vitiating the deductive method as by putting men off from exact inquiries. More to our present purpose were the supposed cataclysms, or extraordinary convulsions of the earth, a belief in which long hindered the progress of Geology. Again, in Biology, Psychology, and Sociology many explanations have depended upon the doctrine that any improvement of structure or faculty acquired by an individual may be inherited by his descendants: as that, if an animal learns to climb trees, his offspring have a greater aptitude for that mode of life; that if a man tries to be good, his children find it easier to be virtuous; that if the inhabitants of a district carry on cloth-work, it becomes easier for each successive generation to acquire dexterity in that art. But now the inheritability of powers acquired by the individual through his own efforts, is disputed; and, if the denial be made good, all such explanations as the above must be revised.

If, then, the premises of a deductive argument be vitiated in any of these four ways, its conclusion will fail to agree with the results of observation and experiment, unless, of course, one kind of error happen to be cancelled by another that is 'equal and opposite.' We now come to a variation of the method of combining Induction with Deduction, so important as to require separate treatment.

Section 5. The Inverse or Historical Method has of late years become remarkably fruitful. When the forces determining a phenomenon are too numerous, or too indefinite, to be combined in a direct deduction, we may begin by collecting an empirical law of the phenomenon (as that 'the democracies of City-States are arbitrary and fickle'), and then endeavour to show by deductions from "the nature of the case," that is, from a consideration of the circumstances and forces known to be operative (of which, in the

above instance, the most important is sympathetic contagion), that such a law was to be expected. Deduction is thus called in to verify a previous induction; whereas in the 'Physical Method' a deduction was verified by comparing it with an induction or an experiment; hence the method now to be discussed has been named the Inverse Deductive Method.

But although it is true that, in such inquiries as we are now dealing with, induction generally takes the lead; yet I cannot think that the mere order in which the two logical processes occur is the essential distinction between the two ways of combining them. For, in the first place, in investigations of any complexity both induction and deduction recur again and again in whatever order may be most convenient; and, in the second place, the so-called 'inverse order' is sometimes resorted to in Astronomy and Physics. For example, Kepler's Laws were first collected empirically from observations of the planetary motions, and afterwards deduced by Newton from the Law of Gravitation; this, then, was the Inverse Method; but the result is something very different from any that can be obtained by the Historical Method. The essential difference between the Physical and Historical Methods is that, in the former, whether Direct or Inverse, the deductive process, when complete, amounts to exact demonstration; whereas, in the latter, the deductions may consist of qualitative reasonings, and the results are indefinite. They establish–(1) a merely probable connection between the phenomena according to an empirical law (say, between City-democracy and fickle politics); (2) connect this with other historical or social generalisations, by showing that they all alike flow from the same causes, namely, from the nature of races of men under certain social and geographical conditions; and (3) explain why such empirical laws may fail, according to the differences that prevail among races of men and among the conditions under which they live. Thus, seeing how rapidly excitement is propagated by the chatter, grimacing, and gesticulation of townsmen, it is probable enough that the democracy of a City-state should be fickle (and arbitrary, because irresponsible). A similar phenomenon of panic, sympathetic hope and despair, is exhibited by every stock-exchange, and is not peculiar to political life. And when political opinion is not manufactured solely in the reverberating furnace of a city,

fickleness ceases to characterise democracy; and, in fact, is not found in Switzerland, or the United States, nor in France so far as politics, depend upon the peasantry.

This is called the Historical Method, then, because it is especially useful in explaining the movements of history, and in verifying the generalisations of political and social science. We must not, however, suppose that its use is confined to such studies. Only a ridiculous pedantry would allot to each subject its own method and forbid the use of any other; as if it were not our capital object to establish truth by any means. Wherever the forces determining a phenomenon are too numerous or too indefinite to be combined in a deductive demonstration, there the Historical Method is likely to be useful; and this seems often to be the case in Geology and Biology, as well as in the Science of History, or Sociology, and its various subsidiary studies.

Consider upon what causes historical events depend: the customs, character, and opinions of all the people concerned; the organisation of their government, and the character of their religious institutions; the development of industry among them, of the military art, of fine art, literature and science; their relations, commercial, political and social, with other nations; the physical conditions of climate and geographical position amidst which they live. Hardly an event of importance occurs in any nation that is not, directly or indirectly, influenced by every one of these circumstances, and that does not react upon them. Now, from the nature of the Canons of direct Induction, a satisfactory employment of them in such a complex and tangled situation as history presents, is rarely possible; for they all require the actual or virtual isolation of the phenomenon under investigation. They also require the greatest attainable immediacy of connection between cause and effect; whereas the causes of social events may accumulate during hundreds of years. In collecting empirical laws from history, therefore, only very rough inductions can be hoped for, and we may have to be content with simple enumeration. Hence the importance of supporting such laws by deduction from the nature of the case, however faint a probability of the asserted connection is thereby raised; and this even if each law is valued merely for its own sake. Still more, if anything worth the name of

Historical Science is to be constructed, must a mere collection of such empiricisms fail to content us; and the only way to give them a scientific character is to show deductively their common dependence upon various combinations of the same causes. Yet even those who profess to employ the Historical Method often omit the deductive half of it; and of course 'practical politicians' boast of their entire contentment with what they call 'the facts.'

Sometimes, however, politicians, venturing upon deductive reasoning, have fallen into the opposite error of omitting to test their results by any comparison with the facts: arguing from certain 'Rights of Man,' or 'Interests of Classes,' or 'Laws of Supply and Demand,' that this or that event will happen, or ought to happen, without troubling themselves to observe whether it does happen or ever has happened. This method of Deduction without any empirical verification, is called by Mill the Geometrical; and, plainly, it can be trustworthy only where there is no actual conflict of forces to be considered. In pure mathematical reasoning about space, time, and number, provided the premises and the reasoning be correct, verification by a comparison with the facts may be needless, because there is no possibility of counteraction. But when we deal with actual causes, no computation of their effects can be relied upon without comparing our conclusions with the facts: not even in Astronomy and Physics, least of all in Politics.

Burke, then, has well said that "without the guide and light of sound, well-understood principles all our reasoning in politics, as in everything else, would be only a confused jumble of particular facts and details without the means of drawing any sort of theoretical or practical conclusion"; but that, on the other hand, the statesman, who does not take account of circumstances, infinite and infinitely combined, "is not erroneous, but stark mad–he is metaphysically mad" (On the Petition of the Unitarians). There is, or ought to be, no logical difference between the evidence required by a statesman and that appealed to by a philosopher; and since, as we have seen, the combination of principles with circumstances cannot, in solving problems of social science, be made with the demonstrative precision that belongs to astronomical and physical investigations, there remains the Historical Method as above described.

Examples of the empirical laws from which this method begins abound in histories, newspapers, and political discussions, and are of all shades of truth or half-truth: as that 'History consists in the biographies of great men'; in other words, that the movements of society are due to exceptional personal powers, not to general causes; That at certain epochs great men occur in groups; That every Fine Art passes through periods of development, culmination and decline; That Democracies tend to change into Despotisms; That the possession of power, whether by classes or despots, corrupts the possessor: That 'the governments most distinguished for sustained vigour and abilities have generally been aristocracies'; That 'revolutions always begin in hunger'; That civilisation is inimical to individuality; That the civilisation of the country proceeds from the town; That 'the movement of progressive societies has hitherto been a movement from Status to Contract (i.e., from a condition in which the individual's rights and duties depend on his caste, or position in his family as slave, child, or patriarch, to a condition in which his rights and duties are largely determined by the voluntary agreements he enters into)'; and this last is treated by H. Spencer as one aspect of the law first stated by Comte, that the progress of societies is from the military to the industrial state.

The deductive process we may illustrate by Spencer's explanation of the co-existence in the military state of those specific characters, the inductive proof of which furnished an illustration of the method of Agreement (ch. xvi. Section 1). The type of the military State involves the growth of the warrior class, and the treatment of labourers as existing solely to support the warriors; the complete subordination of all individuals to the will of the despotic soldier-king, their property, liberty and life being at the service of the State; the regimentation of society, not only for military, but also for civil purposes; the suppression of all private associations, etc. Now all these characteristics arise from their utility for the purpose of war, a utility amounting to necessity if war is the State's chief purpose. For every purpose is best served when the whole available force co-operates toward it: other things equal, the bigger the army the better; and to increase it, men must be taken from industry, until only just enough remain to feed and equip the soldiers. As this arrangement is not to everybody's taste, there

must be despotic control; and this control is most effective through regimentation by grades of command. Private associations, of course, cannot live openly in such a State, because they may have wills of their own and are convenient for conspiracy. Thus the induction of characteristics is verified by a deduction of them from the nature of the case.

Section 6. The greater indefiniteness of the Historical compared with the Physical Method, both in its inductions and in its deductions, makes it even more difficult to work with. It wants much sagacity and more impartiality; for the demon of Party is too much with us. Our first care should be to make the empirical law as nearly true as possible, collecting as many as we can of the facts which the law is supposed to generalise, and examining them according to the canons of Induction, with due allowance for the imperfect applicability of those canons to such complex, unwieldy, and indefinite instances. In the examples of such laws given above, it is clear that in some cases no pains have been taken to examine the facts. What is the inductive evidence that Democracies change into Despotisms; that revolutions always begin in hunger; or that civilisation is inimical to individuality? Even Mill's often quoted saying, "that the governments remarkable in history for sustained vigour and ability have generally been aristocracies," is oddly over-stated. For if you turn to the passage (Rep. Gov. chap. vi.), the next sentence tells you that such governments have always been aristocracies of public functionaries; and the next sentence but one restricts, apparently, the list of such remarkable governments to two–Rome and Venice. Whence, then, comes the word "generally" into Mill's law?

As to deducing our empirical law from a consideration of the nature of the case, it is obvious that we ought–(a) to take account of all the important conditions; (b) to allow weight to them severally in proportion to their importance; and© not to include in our estimates any condition which we cannot show to be probably present and operative. Thus the Great-Man-Theory of history must surely be admitted to assign a real condition of national success. The great man organises, directs, inspires: is that nothing? On the other hand, to recognise no other condition of national success is the manifest frenzy of a mind in the mythopÅ"ic age. We must

allow the great man his due weight, and then inquire into the general conditions that (a) bring him to birth in one nation rather than another, and (b) give him his opportunity.

Mill's explanation of the success of the aristocratic governments of Rome and Venice is, that they were, in fact, bureaucracies; that is to say, their members were trained in the science and art of administration and command. Here, again, we have, no doubt, a real condition; but is it the only one? The popular mind, which little relishes the scaling down of Mill's original law to those two remote cases, is persuaded that an aristocracy is the depository of hereditary virtue, especially with reference to government, and would at once ascribe to this circumstance the greater part of the success of any aristocratic constitution. Now, if the effects of training are inherited, they must, in an hereditary aristocracy, increase the energy of the cause assigned by Mill; but, if not, such heredity is a condition "not present or not operative." Still, if families are ennobled for their extraordinary natural powers of administration or command (as sometimes happens), it is agreed on all hands that innate qualities are inheritable; at least, if care be taken to intermarry with families similarly distinguished, and if by natural or artificial selection all the failures among the offspring be eliminated. The Spartans had some crude notion of both these precautions; and if such measures had been widely adopted, we might deduce from the doctrine of heredity a probability in favour of Mill's original proposition, and thereby verify it in its generality, if it could be collected from the facts.

The Historical Method may be further illustrated by the course adopted in that branch of Social Science which has been found susceptible of the most extensive independent development, namely, Economics. First, by way of contrast, I should say that the abstract, or theoretical treatment of Economics follows the Physical Method; because, as Mill explains, although the phenomena of industry are no doubt influenced, like other social affairs, by all the other circumstances of Society, government, religion, war, art, etc.; yet, where industry is most developed, as in England and the United States, certain special conditions affecting it are so much the most important that, for the purpose at least of a first outline of the science, they may conveniently be considered as

the only ones. These conditions are: (1) the general disposition of men to obtain wealth with as little trouble as possible, and (2) to spend it so as to obtain the greatest satisfaction of their various desires; (3) the facts that determine population; and (4) the tendency of extractive industry, when pushed beyond a certain limit without any improvement in the industrial arts, to yield "diminishing returns." From these premises it is easy to infer the general laws of prices, of wages and interest (which are the prices of labour and of the use of capital), and of rent; and it remains to verify these laws by comparing them with the facts in each case; and (if they fail to agree with the facts) to amend them, according to the Method of Residues, by taking account of those influential conditions which were omitted from the first draft of the theory.

Whilst, however, this is usually the procedure of those inquirers who have done most to give Economics its scientific character, to insist that no other plan shall be adopted would be sheer pedantry; and Dr. Keynes has shown, in his Scope and Method of Political Economy, that Mill has himself sometimes solved economic problems by the Historical Method. With an analysis of his treatment of Peasant Proprietorship (Political Economy, B. II., cc. 7 and 8) we may close this section. Mill first shows inductively, by collecting evidence from Switzerland, Germany, Norway, Belgium, and France (countries differing in race, government, climate and situation), that peasant proprietors are superhumanly industrious; intelligent cultivators, and generally intelligent men; prudent, temperate, and independent, and that they exercise self-control in avoiding improvident marriages. This group of empirical generalisations as to the character of peasant proprietors he then deduces from the nature of the case: their industry, he says, is a natural consequence of the fact that, however much they produce, it is all their own; they cultivate intelligently, because for generations they have given their whole mind to it; they are generally intelligent men, because the variety of work involved in small farming, requiring foresight and calculation, necessarily promotes intelligence; they are prudent, because they have something to save, and by saving can improve their station and perhaps buy more land; they are temperate, because intemperance is incompatible with industry and prudence; they are independent, because secure of the necessaries of life, and from having property

to fall back upon; and they avoid improvidence in marriage, because the extent and fertility of their fields is always plainly before them, and therefore how many children they can maintain is easily calculated. The worst of them is that they work too hard and deny themselves too much: but, over the greater part of the world, other peasantry work too hard; though they can scarcely be said to deny themselves too much; since all their labour for others brings them no surplus to squander upon self-indulgence.

Section 7. The foregoing account of the Historical Method is based upon Mill's discussions in B. VI. of his Logic, especially cc. 6 to 11. Mill ascribes to Comte the first clear statement of the method; and it is highly scientific, and important in generalising the connections of historical events. But perhaps the expression, 'Historical Method,' is more frequently applied to the Comparative Method, as used in investigating the history of institutions or the true sense of legends.

(1) Suppose we are trying to explain the institution of capital punishment as it now exists in England. (1) We must try to trace the history of it back to the earliest times; for social custom and tradition is one line of causation. At present the punishment of death is legally incident only to murder and high treason. But early in the last century malefactors were hung for forgery, sheep-stealing, arson and a long list of other offences down to pocket-picking: earlier still the list included witchcraft and heresy. At present hanging is the only mode of putting a malefactor to death; but formerly the ways of putting to death included also burning, boiling, pressing, beheading, and mixed modes. Before the Restoration, however, the offences punishable with death were far fewer than they afterwards became; and until the twelfth century, the penalty of death might be avoided by paying compensation, the wer-geld.

(2) Every change in the history of an institution must be explained by pointing to the special causes in operation during the time when the change was in progress. Thus the restriction of the death penalty, in the nineteenth century, to so few offences was due partly to the growth of humane feelings, partly to the belief that the infliction, or threat, of the extreme penalty had failed to enforce the

law and had demoralised the administration of Justice. The continual extension of the death penalty throughout the eighteenth century may be attributed to a belief that it was the most effectual means of deterring evil-doers when the means of detecting and apprehending criminals were feeble and ill-organised. The various old brutal ways of execution were adopted sometimes to strike terror, sometimes for vengeance, sometimes from horror of the crime, or even from 'conscientious scruples';–which last were the excuse for preferring the burning of heretics to any sort of bloodshed.

(3) The causes of any change in the history of an institution in any country may not be directly discoverable: they must then be investigated by the Comparative Method. Again, the recorded history of a nation, and of all its institutions, followed backwards, comes at last to an end: then the antecedent history must also be supplied by the Comparative Method; whose special use is to indicate the existence of facts for which there is no direct evidence.

This method rests upon the principle that where the causes are alike the effects will be alike, and that similar effects are traceable to similar causes. Every department of study–Astronomy, Chemistry, Zoology, Sociology–is determined by the fact that the phenomena it investigates have certain common characteristics; and we are apt to infer that any process observed in some of these phenomena, if depending on those common characteristics, will be found in others. For example, the decomposition, or radio-activity, of certain elements prepares one to believe that all elements may exhibit it. Where the properties of an object are known to be closely interdependent, as in the organisation of plants, animals and societies, we are especially justified in inferring from one case to another. The whole animal Kingdom has certain common characters–the metabolic process, dependence upon oxygen, upon vegetable food (ultimately), heredity, etc., and, upon this ground, any process (say, the differentiation of species by Natural Selection) that has been established for some kinds of animal is readily extended to others. If instead of the whole animal Kingdom we take some district of it–Class, Order, Family–our confidence in such inferences increases; because the common characters are more numerous and the conditions of life are more alike; or, in

other words, the common causes are more numerous that initiate and control the development of nearly allied animals. For such reasons a few fragmentary remains of an extinct animal enable the palÃ_ontologist to reconstruct with some probability an outline of its appearance, organisation, food, habitat and habits.

Applied to History, the Comparative Method rests upon an assumption (which the known facts of (say) 6,000 years amply justify) that human nature, after attaining a recognisable type as homo sapiens, is approximately uniform in all countries and in all ages, though more especially where states of culture are similar. Men living in society are actuated by similar motives and reasons in similar ways; they are all dependent upon the supply of food and therefore on the sun and the seasons and the weather and upon means of making fire, and so on. Accordingly, they entertain similar beliefs, and develop similar institutions through similar series of changes. Hence, if in one nation some institution has been altered for reasons that we cannot directly discover, whereas we know the reasons why a similar change was adopted elsewhere, we may conjecture with more or less probability, after making allowance for differences in other circumstances, that the motives or causes in the former case were similar to those in the latter, or in any cases that are better known. Or, again, if in one nation we cannot trace an institution beyond a certain point, but can show that elsewhere a similar institution has had such or such an antecedent history, we may venture to reconstruct with more or less probability the earlier history of that institution in the nation we are studying.

Amongst the English and Saxon tribes that settled in Britain, death was the penalty for murder, and the criminal was delivered to the next-of-kin of his victim for execution; he might, however, compound for his crime by paying a certain compensation. Studying the history of other tribes in various parts of the world, we are able, with much probability, to reconstruct the antecedents of this death-penalty in our own prehistoric ages, and to trace it to the blood-feud; that is, to a tribal condition in which the next-of-kin of a murdered man was socially and religiously bound to avenge him by slaying the murderer or one of his kindred. This duty of revenge is sometimes (and perhaps was at first everywhere)

regarded as necessary to appease the ghost of the victim; sometimes as necessary to compensate the surviving members of his family. In the latter case, it is open to them to accept compensation in money or cattle, etc. Whether the kin will be ready to accept compensation must depend upon the value they set upon wealth in comparison with revenge; but for the sake of order and tribal strength, it is the interest of the tribe, or its elders, or chieftain, to encourage or even to enforce such acceptance. It is also their interest to take the questions–whether a crime has been committed, by whom, and what compensation is due–out of the hands of the injured party, and to submit them to some sort of court or judicial authority. At first, following ancient custom as much as possible, the act of requital, or the choice of accepting compensation, is left to the next-of-kin; but with the growth of central power these things are entrusted to ministers of the Government. Then revenge has undergone its full transformation into punishment. Very likely the wrong itself will come to be treated as having been done not to the kindred of the murdered man, but to the State or the King, as in fact a "breach of the King's peace." This happened in our own history.

(4) The Comparative Method assumes that human nature is approximately the same in different countries and ages; but, of course, 'approximately' is an important word. Although there is often a striking and significant resemblance between the beliefs and institutions of widely separated peoples, we expect to draw the most instructive parallels between those who are nearly related by descent, or neighbourhood, or culture. To shed light upon our own manners, we turn first to other Teutons, then to Slavonians and Kelts, or other Aryans, and so on; and we prefer evidence from Europe to examples from Africa.

(5) As to national culture, that it exhibits certain 'stages' of development is popularly recognised in the distinction drawn between savages, barbarians and civilised folk. But the idea remains rather vague; and there is not space here to define it. I refer, therefore, to the classifications of stages of culture given by A. Sutherland, (Origin and Growth of Moral Instinct, Vol. I, p. 103), and L.T. Hobhouse (Morals in Evolution, c. 2). That in any 'state of Society,' its factors–religion, government, science,

etc.–are mutually dependent, was a leading doctrine with Comte, adopted by Mill. There must be some truth in it; but in some cases we do not understand social influences sufficiently well to trace the connection of factors; and whilst preferring to look for historical parallels between nations of similar culture, we find many cases in which barbarous or savage customs linger in a civilised country.

(6) It was another favourite doctrine with Comte, also adopted by Mill–that the general state of culture is chiefly determined by the prevailing intellectual condition of a people, especially by the accepted ground of explanation–whether the will of supernatural beings, or occult powers, or physical antecedents: the "law of three stages," Fetichism, Metaphysics, Positivism. And this also is, at least, so far true, that it is useless to try to interpret the manners and institutions of any nation until we know its predominant beliefs. Magic and animism are beliefs everywhere held by mankind in early stages of culture, and they influence every action of life. But that is not all: these beliefs retain their hold upon great multitudes of civilised men and affect the thoughts of the most enlightened. Whilst the saying 'that human nature is the same in all ages' seems to make no allowance for the fact that, in some nations, a considerable number of individuals has attained to powers of deliberation, self-control, and exact reasoning, far above the barbarous level, it is yet so far true that, even in civilised countries, masses of people, were it not for the example and instruction of those individuals, would fall back upon magic and animism and the manners that go with those beliefs. The different degrees of enlightenment enjoyed by different classes of the population often enable the less educated to preserve a barbarous custom amidst many civilised characteristics of the national life.

Section 8. Historical reasoning must start from, or be verified by, observations. If we are writing the history of ourselves: if of another time or country, we can observe some of the present conditions of the country, its inhabitants, language, manners, institutions, which are effects of the past and must be traceable to it; we may also be able to observe ancient buildings or their ruins, funerary remains, coins, dating from the very times we are to treat of. Our own observations, of course, are by no means free from error.

But even in treating of our own age and country, most of our information must be derived from the testimony of others, who may have made mistakes of observation and further mistakes in reporting their observations, or may have intentionally falsified them. Testimony is of two kinds: Oral; and Written, inscribed or printed. In investigating the events of a remote age, nearly all our direct evidence must be some sort of testimony.

(1) Oral testimony depends upon the character of the witness; and the best witness is not perfectly trustworthy; for he may not have observed accurately, or he may not have reported correctly; especially if some time elapsed between the event and his account of it; for no man's memory is perfect. Since witnesses vary widely in capacity and integrity, we must ask concerning any one of them–was he a good judge of what he saw, and of what was really important in the event? Had he good opportunities of knowing the circumstances? Had he any interest in the event–personal, or partisan, or patriotic? Such interests would colour his report; and so would the love of telling a dramatic story, if that was a weakness of his. Nay, a love of truth might lead him to modify the report of what he remembered if–as he remembered it–the matter seemed not quite credible. We must also bear in mind that, for want of training, precision in speaking the truth is not understood or appreciated by many honest people even now, still less in unscientific ages.

Oral tradition is formed by passing a report from one to another, generation by generation; and it is generally true that such a tradition loses credit at every step, because every narrator has some weakness. However, the value of tradition depends upon the motives people have to report correctly, and on the form of the communication, and on whether monuments survive in connection with the story. Amongst the things best remembered are religious and magic formulÃ_, heroic poems, lists of ancestors, popular legends about deeply impressive events, such as migrations, conquests, famines, plagues. We are apt now to underrate the value of tradition, because the use of writing has made tradition less important, and therefore less pains are taken to preserve it. In the middle of last century, it was usual (and then quite justifiable) to depreciate oral tradition as nearly worthless; but the spread of

archaeological and anthropological research, and the growth of the Comparative Method, have given new significance to legends and traditions which, merely by themselves, could not deserve the slightest confidence.

(2) As to written evidence, contemporary inscriptions–such as are found on rocks and stones and bricks in various parts of the world, and most abundantly in Egypt and Western Asia–are of the highest value, because least liable to fraudulent abuse; but must be considered with reference to the motives of those who set them forth. Manuscripts and books give rise to many difficulties. We have to consider whether they were originally written by some one contemporary with the events recorded: if so they have the same value as immediate oral testimony, provided they have not been tampered with since. But if not contemporary records, they may have been derived from other records that were contemporary, or only from oral tradition. In the latter case they are vitiated by the weakness of oral tradition. In the former case, we have to ask what was the trustworthiness of the original records, and how far do the extant writings fairly represent those records?

Our answers to these questions will partly depend upon what we know or can discover of the authors of the MSS. or books. Who was the author? If a work bears some man's name, did he really write it? The evidence bearing upon this question is usually divided into internal, external and mixed; but perhaps no evidence is purely internal, if we define it as that which is derived entirely from the work itself. Under the name of internal evidence it is usual to put the language, the style, consistency of ideas; but if we had no grounds of judgment but the book itself, we could not possibly say whether the style was the author's: this requires us to know his other works. Nor could we say whether the language was that of his age, unless we knew other literature of the same age; nor even that different passages seem to be written in the manner of different ages, but for our knowledge of change in other literatures. There must in every case be some external reference. Thus we judge that a work is not by the alleged author, nor contemporary with him, if words are used that only became current at a later date, or are used in a sense that they only later acquired, or if later writers are imitated, or if events are mentioned that happened later

('anachronism'). Books are sometimes forged outright, that is, are written by one man and deliberately fathered upon another; but sometimes books come to be ascribed to a well-known name, which were written by some one else without fraudulent intent, dramatically or as a rhetorical exercise.

As to external evidence, if from other sources we have some knowledge of the facts described in a given book, and if it presents no serious discrepancies with those facts, this is some confirmation of a claim to contemporaneity. But the chief source of external evidence is other literature, where we may find the book in question referred to or quoted. Such other literature may be by another author, as when Aristotle refers to a dialogue of Plato's, or Shakespeare quotes Marlowe; or may be other work of the author himself, as when Aristotle in the Ethics refers to his own Physics, or Chaucer in The Canterbury Tales mentions as his own The Legend of Good Women, and in The Legend gives a list of other works of his. This kind of argument assumes that the authorship of the work we start from is undisputed; which is practically the case with the Ethics and The Canterbury Tales.

But, now, granting that a work is by a good author, or contemporary with the events recorded, or healthily related to others that were contemporary, it remains to consider whether it has been well preserved and is likely to retain its original sense. It is, therefore, desirable to know the history of a book or MS., and through whose hands it has passed. Have there been opportunities of tampering with it; and have there been motives to do so? In reprinting books, but still more in copying MSS., there are opportunities of omitting or interpolating passages, or of otherwise altering the sense. In fact, slight changes are almost sure to be made even without meaning to make them, especially in copying MSS., through the carelessness or ignorance of transcribers. Hence the oldest MS. is reckoned the best.

If a work contains stories that are physically impossible, it shows a defect of judgment in the author, and decreases our confidence in his other statements; but it does not follow that these others are to be rejected. We must try to compare them with other evidence. Even incredible stories are significant: they show what people

were capable of believing, and, therefore, under what conditions they reasoned and acted. One cause of the incredibility of popular stories is the fusion of legend with myth. A legend is a traditionary story about something that really happened: it may have been greatly distorted by stupidity, or exaggeration, or dramatisation, or rationalisation, but may still retain a good deal of the original fact. A myth, however, has not necessarily any basis of fact: it may be a sort of primitive philosophy, an hypothesis freely invented to explain some fact in nature, such as eclipses, or to explain some social custom whose origin is forgotten, such as the sacrificing of a ram.

All historical conclusions, then, depend on a sum of convergent and conflicting probabilities in the nature of circumstantial evidence. The best testimony is only highly probable, and it is always incomplete. To complete the picture of any past age there is no resource but the Comparative Method. We use this method without being aware of it, whenever we make the records of the last generation intelligible to ourselves by our own experience. Without it nothing would be intelligible: an ancient coin or weapon would have no meaning, were we not acquainted with the origins and uses of other coins and weapons. Generally, the further we go back in history, the more the evidence needs interpretation and reconstruction, and the more prominent becomes the appeal to the Comparative Method. Our aim is to construct a history of the world, and of the planet as part of the world, and of mankind as part of the life of the planet, in such a way that every event shall be consistent with, and even required by, the rest according to the principle of Causation.