

Chapter XX.

Of Analogy.

§ 1. The word Analogy, as the name of a mode of reasoning, is generally taken for some kind of argument supposed to be of an inductive nature, but not amounting to a complete induction. There is no word, however, which is used more loosely, or in a greater variety of senses, than Analogy. It sometimes stands for arguments which may be examples of the most rigorous induction. Archbishop Whately, for instance, following Ferguson and other writers, defines Analogy conformably to its primitive acceptation, that which was given to it by mathematicians: Resemblance of Relations. In this sense, when a country which has sent out colonies is termed the mother country, the expression is analogical, signifying that the colonies of a country stand in the same *relation* to her in which children stand to their parents. And if any inference be drawn from this resemblance of relations, as, for instance, that obedience or affection is due from colonies to the mother country, this is called reasoning by analogy. Or, if it be argued that a nation is most beneficially governed by an assembly elected by the people, from the admitted fact that other associations for a common purpose, such as joint-stock companies, are best managed by a committee chosen by the parties interested; this, too, is an argument from analogy in the preceding sense, because its foundation is, not that a nation is like a joint-stock company, or Parliament like a board of directors, but that Parliament stands in the same *relation* to the nation in which a board of directors stands to a joint-stock company. Now, in an argument of this nature, there is no inherent inferiority of conclusiveness. Like other arguments from resemblance, it may amount to nothing, or it may be a perfect and conclusive induction. The circumstance in which the two cases resemble, may be capable of being shown to be the *material* circumstance; to be that on which all the consequences, necessary to be taken into account in the particular discussion, depend. In the example last given, the resemblance is one of relation; the *fundamentum relationis* being the management, by a few persons, of affairs in which a much greater number are interested along with them. Now, some may contend that this circumstance which is common to the two cases, and the various consequences which follow from it, have the chief share in determining all the effects which make up what we term good or bad administration. If they can establish this, their argument has the force of a rigorous induction; if they can not, they are said to have failed in proving the analogy between the two cases; a mode of speech which implies that when the analogy can be proved, the argument founded on it can not be resisted.

§ 2. It is on the whole more usual, however, to extend the name of analogical evidence to arguments from any sort of resemblance, provided they do not amount to a complete induction; without peculiarly distinguishing resemblance of relations. Analogical reasoning, in this sense, may be reduced to the following formula: 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. But we have nothing here by which to discriminate analogy from induction, since this type will serve for all reasoning from experience. In the strictest induction, equally with the faintest analogy, we conclude because A resembles B in one or more properties, that it does so in a certain other property. The difference is, that in the case of a complete induction it has been previously shown, by due comparison of instances, that there is an invariable conjunction between the former property or properties and the latter property; but in what is called analogical reasoning, no such conjunction has been made out. There have been no opportunities of putting in practice the Method of Difference, or even the Method of Agreement; but we conclude (and that is all which the argument of analogy amounts to) that a fact *m*, known to be true of A, is more likely to be true of B if B agrees with A in some of its properties (even though no connection is known to exist between *m* and those properties), than if no resemblance at all could be traced between B and any other thing known to possess the attribute *m*.

To this argument it is of course requisite that the properties common to A with B shall be merely not known to be connected with *m*; they must not be properties known to be unconnected with it. If, either by processes of elimination, or by deduction from previous knowledge of the laws of the properties in question, it can be concluded that they have nothing to do with *m*, the argument of analogy is put out of court. The supposition must be that *m* is an effect really dependent on some property of A, but we know not on which. We can not

point out any of the properties of A, which is the cause of *m*, or united with it by any law. After rejecting all which we know to have nothing to do with it, there remain several between which we are unable to decide; of which remaining properties, B possesses one or more. This, accordingly, we consider as affording grounds, of more or less strength, for concluding by analogy that B possesses the attribute *m*.

There can be no doubt that every such resemblance which can be pointed out between B and A, affords some degree of probability, beyond what would otherwise exist, in favor of the conclusion drawn from it. If B resembled A in all its ultimate properties, its possessing the attribute *m* would be a certainty, not a probability; and every resemblance which can be shown to exist between them, places it by so much the nearer to that point. If the resemblance be in an ultimate property, there will be resemblance in all the derivative properties dependent on that ultimate property, and of these *m* may be one. If the resemblance be in a derivative property, there is reason to expect resemblance in the ultimate property on which it depends, and in the other derivative properties dependent on the same ultimate property. Every resemblance which can be shown to exist, affords ground for expecting an indefinite number of other resemblances; the particular resemblance sought will, therefore, be oftener found among things thus known to resemble, than among things between which we know of no resemblance.

For example, I might infer that there are probably inhabitants in the moon, because there are inhabitants on the earth, in the sea, and in the air: and this is the evidence of analogy. The circumstance of having inhabitants is here assumed not to be an ultimate property, but (as is reasonable to suppose) a consequence of other properties; and depending, therefore, in the case of the earth, on some of its properties as a portion of the universe, but on which of those properties we know not. Now the moon resembles the earth in being a solid, opaque, nearly spherical substance, appearing to contain, or to have contained, active volcanoes; receiving heat and light from the sun, in about the same quantity as our earth; revolving on its axis; composed of materials which gravitate, and obeying all the various laws resulting from that property. And I think no one will deny that if this were all that was known of the moon, the existence of inhabitants in that luminary would derive from these various resemblances to the earth, a greater degree of probability than it would otherwise have; though the amount of the augmentation it would be useless to attempt to estimate.

If, however, every resemblance proved between B and A, in any point not known to be immaterial with respect to *m*, forms some additional reason for presuming that B has the attribute *m*; it is clear, *à contra*, that every dissimilarity which can be proved between them furnishes a counter-probability of the same nature on the other side. It is not, indeed, unusual that different ultimate properties should, in some particular instances, produce the same derivative property; but on the whole it is certain that things which differ in their ultimate properties, will differ at least as much in the aggregate of their derivative properties, and that the differences which are unknown will, on the average of cases, bear some proportion to those which are known. There will, therefore, be a competition between the known points of agreement and the known points of difference in A and B; and according as the one or the other may be deemed to preponderate, the probability derived from analogy will be for or against B's having the property *m*. The moon, for instance, agrees with the earth in the circumstances already mentioned; but differs in being smaller, in having its surface more unequal, and apparently volcanic throughout, in having, at least on the side next the earth, no atmosphere sufficient to refract light, no clouds, and (it is therefore concluded) no water. These differences, considered merely as such, might perhaps balance the resemblances, so that analogy would afford no presumption either way. But considering that some of the circumstances which are wanting on the moon are among those which, on the earth, are found to be indispensable conditions of animal life, we may conclude that if that phenomenon does exist in the moon (or at all events on the nearer side), it must be as an effect of causes totally different from those on which it depends here; as a consequence, therefore, of the moon's differences from the earth, not of the points of agreement. Viewed in this light, all the resemblances which exist become presumptions against, not in favor of, the moon's being inhabited. Since life can not exist there in the manner in which it exists here, the greater the resemblance of the lunar world to the terrestrial in other respects, the less reason we have to believe that it can contain life.

There are, however, other bodies in our system, between which and the earth there is a much closer resemblance; which possess an atmosphere, clouds, consequently water (or some fluid analogous to it), and even give strong indications of snow in their polar regions; while the cold, or heat, though differing greatly on the average from ours, is, in some parts at least of those planets, possibly not more extreme than in some regions of our own which are habitable. To balance these agreements, the ascertained differences are chiefly in the average light and heat, velocity of rotation, density of material, intensity of gravity, and similar circumstances of a secondary kind. With regard to these planets, therefore, the argument of analogy gives a decided preponderance in favor of their resembling the earth in any of its derivative properties, such as that of having inhabitants; though when we consider how immeasurably multitudinous are those of their properties which we are entirely ignorant of, compared with the few which we know, we can attach but trifling weight to any considerations of resemblance in which the known elements bear so inconsiderable a proportion to the unknown.

Besides the competition between analogy and diversity, there may be a competition of conflicting analogies. The new case may be similar in some of its circumstances to cases in which the fact *m* exists, but in others to cases in which it is known not to exist. Amber has some properties in common with vegetable, others with mineral products. A painting of unknown origin may resemble, in certain of its characters, known works of a particular master, but in others it may as strikingly resemble those of some other painter. A vase may bear some analogy to works of Grecian, and some to those of Etruscan, or Egyptian art. We are of course supposing that it does not possess any quality which has been ascertained, by a sufficient induction, to be a conclusive mark either of the one or of the other.

§ 3. Since the value of an analogical argument inferring one resemblance from other resemblances without any antecedent evidence of a connection between them, depends on the extent of ascertained resemblance, compared first with the amount of ascertained difference, and next with the extent of the unexplored region of unascertained properties; it follows that where the resemblance is very great, the ascertained difference very small, and our knowledge of the subject-matter tolerably extensive, the argument from analogy may approach in strength very near to a valid induction. If, after much observation of B, we find that it agrees with A in nine out of ten of its known properties, we may conclude with a probability of nine to one, that it will possess any given derivative property of A. If we discover, for example, an unknown animal or plant, resembling closely some known one in the greater number of the properties we observe in it, but differing in some few, we may reasonably expect to find in the unobserved remainder of its properties, a general agreement with those of the former; but also a difference corresponding proportionately to the amount of observed diversity.

It thus appears that the conclusions derived from analogy are only of any considerable value, when the case to which we reason is an adjacent case; adjacent, not as before, in place or time, but in circumstances. In the case of effects of which the causes are imperfectly or not at all known, when consequently the observed order of their occurrence amounts only to an empirical law, it often happens that the conditions which have co-existed whenever the effect was observed, have been very numerous. Now if a new case presents itself, in which all these conditions do not exist, but the far greater part of them do, some one or a few only being wanting, the inference that the effect will occur, notwithstanding this deficiency of complete resemblance to the cases in which it has been observed, may, though of the nature of analogy, possess a high degree of probability. It is hardly necessary to add that, however considerable this probability may be, no competent inquirer into nature will rest satisfied with it when a complete induction is attainable; but will consider the analogy as a mere guide-post, pointing out the direction in which more rigorous investigations should be prosecuted.

It is in this last respect that considerations of analogy have the highest scientific value. The cases in which analogical evidence affords in itself any very high degree of probability, are, as we have observed, only those in which the resemblance is very close and extensive; but there is no analogy, however faint, which may not be of the utmost value in suggesting experiments or observations that may lead to more positive conclusions. When the agents and their effects are out of the reach of further observation and experiment, as in the speculations already alluded to respecting the moon and planets, such slight probabilities are no more than an

interesting theme for the pleasant exercise of imagination; but any suspicion, however slight, that sets an ingenious person at work to contrive an experiment, or affords a reason for trying one experiment rather than another, may be of the greatest benefit to science.

On this ground, though I can not accept as positive truths any of those scientific hypotheses which are unsusceptible of being ultimately brought to the test of actual induction, such, for instance, as the two theories of light, the emission theory of the last century, and the undulatory theory which predominates in the present, I am yet unable to agree with those who consider such hypotheses to be worthy of entire disregard. As is well said by Hartley (and concurred in by a thinker in general so diametrically opposed to Hartley's opinions as Dugald Stewart), "any hypothesis which has so much plausibility as to explain a considerable number of facts, helps us to digest these facts in proper order, to bring new ones to light, and make *experimenta crucis* for the sake of future inquirers." (183) If an hypothesis both explains known facts, and has led to the prediction of others previously unknown, and since verified by experience, the laws of the phenomenon which is the subject of inquiry must bear at least a great similarity to those of the class of phenomena to which the hypothesis assimilates it; and since the analogy which extends so far may probably extend further, nothing is more likely to suggest experiments tending to throw light upon the real properties of the phenomenon, than the following out such an hypothesis. But to this end it is by no means necessary that the hypothesis be mistaken for a scientific truth. On the contrary, that illusion is in this respect, as in every other, an impediment to the progress of real knowledge, by leading inquirers to restrict themselves arbitrarily to the particular hypothesis which is most accredited at the time, instead of looking out for every class of phenomena between the laws of which and those of the given phenomenon any analogy exists, and trying all such experiments as may tend to the discovery of ulterior analogies pointing in the same direction.