

Chapter II.

Of Abstraction, Or The Formation Of Conceptions.

§ 1. The metaphysical inquiry into the nature and composition of what have been called Abstract Ideas, or, in other words, of the notions which answer in the mind to classes and to general names, belongs not to Logic, but to a different science, and our purpose does not require that we should enter upon it here. We are only concerned with the universally acknowledged fact, that such notions or conceptions do exist. The mind can conceive a multitude of individual things as one assemblage or class; and general names do really suggest to us certain ideas or mental representations, otherwise we could not use the names with consciousness of a meaning. Whether the idea called up by a general name is composed of the various circumstances in which all the individuals denoted by the name agree, and of no others (which is the doctrine of Locke, Brown, and the Conceptualists); or whether it be the idea of some one of those individuals, clothed in its individualizing peculiarities, but with the accompanying knowledge that those peculiarities are not properties of the class (which is the doctrine of Berkeley, Mr. Bailey, (207) and the modern Nominalists); or whether (as held by Mr. James Mill) the idea of the class is that of a miscellaneous assemblage of individuals belonging to the class; or whether, finally, it be any one or any other of all these, according to the accidental circumstances of the case; certain it is, that *some* idea or mental conception is suggested by a general name, whenever we either hear it or employ it with consciousness of a meaning. And this, which we may call, if we please, a general idea, *represents* in our minds the whole class of things to which the name is applied. Whenever we think or reason concerning the class, we do so by means of this idea. And the voluntary power which the mind has, of attending to one part of what is present to it at any moment, and neglecting another part, enables us to keep our reasonings and conclusions respecting the class unaffected by any thing in the idea or mental image which is not really, or at least which we do not really believe to be common, to the whole class. (208)

There are, then, such things as general conceptions, or conceptions by means of which we can think generally; and when we form a set of phenomena into a class, that is, when we compare them with one another to ascertain in what they agree, some general conception is implied in this mental operation. And inasmuch as such a comparison is a necessary preliminary to Induction, it is most true that Induction could not go on without general conceptions.

§ 2. But it does not therefore follow that these general conceptions must have existed in the mind previously to the comparison. It is not a law of our intellect, that in comparing things with each other and taking note of their agreement we merely recognize as realized in the outward world something that we already had in our minds. The conception originally found its way to us as the *result* of such a comparison. It was obtained (in metaphysical phrase) by *abstraction* from individual things. These things may be things which we perceived or thought of on former occasions, but they may also be the things which we are perceiving or thinking of on the very occasion. When Kepler compared the observed places of the planet Mars, and found that they agreed in being points of an elliptic circumference, he applied a general conception which was already in his mind, having been derived from his former experience. But this is by no means universally the case. When we compare several objects and find them to agree in being white, or when we compare the various species of ruminating animals and find them to agree in being cloven-footed, we have just as much a general conception in our minds as Kepler had in his: we have the conception of "a white thing," or the conception of "a cloven-footed animal." But no one supposes that we necessarily bring these conceptions with us, and *superinduce* them (to adopt Dr. Whewell's expression) upon the facts: because in these simple cases every body sees that the very act of comparison which ends in our connecting the facts by means of the conception, may be the source from which we derive the conception itself. If we had never seen any white object or had never seen any cloven-footed animal before, we should at the same time and by the same mental act acquire the idea, and employ it for the colligation of the observed phenomena. Kepler, on the contrary, really had to bring the idea with him, and superinduce it upon the facts; he could not evolve it out of them: if he had not already had the idea, he would not have been able to acquire it by a comparison of the planet's positions. But this inability was a mere accident; the idea of an ellipse could have been acquired from the paths of the planets

as effectually as from any thing else, if the paths had not happened to be invisible. If the planet had left a visible track, and we had been so placed that we could see it at the proper angle, we might have abstracted our original idea of an ellipse from the planetary orbit. Indeed, every conception which can be made the instrument for connecting a set of facts, might have been originally evolved from those very facts. The conception is a conception *of* something; and that which it is a conception of, is really *in* the facts, and might, under some supposable circumstances, or by some supposable extension of the faculties which we actually possess, have been detected in them. And not only is this always in itself possible, but it actually happens in almost all cases in which the obtaining of the right conception is a matter of any considerable difficulty. For if there be no new conception required; if one of those already familiar to mankind will serve the purpose, the accident of being the first to whom the right one occurs, may happen to almost any body; at least in the case of a set of phenomena which the whole scientific world are engaged in attempting to connect. The honor, in Kepler's case, was that of the accurate, patient, and toilsome calculations by which he compared the results that followed from his different guesses, with the observations of Tycho Brahe; but the merit was very small of guessing an ellipse; the only wonder is that men had not guessed it before, nor could they have failed to do so if there had not existed an obstinate *a priori* prejudice that the heavenly bodies must move, if not in a circle, in some combination of circles.

The really difficult cases are those in which the conception destined to create light and order out of darkness and confusion has to be sought for among the very phenomena which it afterward serves to arrange. Why, according to Dr. Whewell himself, did the ancients fail in discovering the laws of mechanics, that is, of equilibrium and of the communication of motion? Because they had not, or at least had not clearly, the ideas or conceptions of pressure and resistance, momentum, and uniform and accelerating force. And whence could they have obtained these ideas except from the very facts of equilibrium and motion? The tardy development of several of the physical sciences, for example, of optics, electricity, magnetism, and the higher generalizations of chemistry, he ascribes to the fact that mankind had not yet possessed themselves of the Idea of Polarity, that is, the idea of opposite properties in opposite directions. But what was there to suggest such an idea, until, by a separate examination of several of these different branches of knowledge, it was shown that the facts of each of them did present, in some instances at least, the curious phenomenon of opposite properties in opposite directions? The thing was superficially manifest only in two cases, those of the magnet and of electrified bodies; and there the conception was encumbered with the circumstance of material poles, or fixed points in the body itself, in which points this opposition of properties seemed to be inherent. The first comparison and abstraction had led only to this conception of poles; and if any thing corresponding to that conception had existed in the phenomena of chemistry or optics, the difficulty now justly considered so great, would have been extremely small. The obscurity arose from the fact, that the polarities in chemistry and optics were distinct species, though of the same genus, with the polarities in electricity and magnetism; and that in order to assimilate the phenomena to one another, it was necessary to compare a polarity without poles, such for instance as is exemplified in the polarization of light, and the polarity with (apparent) poles, which we see in the magnet; and to recognize that these polarities, while different in many other respects, agree in the one character which is expressed by the phrase, opposite properties in opposite directions. From the result of such a comparison it was that the minds of scientific men formed this new general conception; between which, and the first confused feeling of an analogy between some of the phenomena of light and those of electricity and magnetism, there is a long interval, filled up by the labors and more or less sagacious suggestions of many superior minds.

The conceptions, then, which we employ for the colligation and methodization of facts, do not develop themselves from within, but are impressed upon the mind from without; they are never obtained otherwise than by way of comparison and abstraction, and, in the most important and the most numerous cases, are evolved by abstraction from the very phenomena which it is their office to colligate. I am far, however, from wishing to imply that it is not often a very difficult thing to perform this process of abstraction well, or that the success of an inductive operation does not, in many cases, principally depend on the skill with which we perform it. Bacon was quite justified in designating as one of the principal obstacles to good induction, general conceptions wrongly formed, "*notiones temerè à rebus abstractæ;*" to which Dr. Whewell adds, that

not only does bad abstraction make bad induction, but that, in order to perform induction well, we must have abstracted well; our general conceptions must be "clear" and "appropriate" to the matter in hand.

§ 3. In attempting to show what the difficulty in this matter really is, and how it is surmounted, I must beg the reader, once for all, to bear this in mind; that although, in discussing the opinions of a different school of philosophy, I am willing to adopt their language, and to speak, therefore, of connecting facts through the instrumentality of a conception, this technical phraseology means neither more nor less than what is commonly called comparing the facts with one another and determining in what they agree. Nor has the technical expression even the advantage of being metaphysically correct. The facts are not *connected*, except in a merely metaphorical acceptance of the term. The *ideas* of the facts may become connected, that is, we may be led to think of them together; but this consequence is no more than what may be produced by any casual association. What really takes place, is, I conceive, more philosophically expressed by the common word Comparison, than by the phrases "to connect" or "to superinduce." For, as the general conception is itself obtained by a comparison of particular phenomena, so, when obtained, the mode in which we apply it to other phenomena is again by comparison. We compare phenomena with each other to get the conception, and we then compare those and other phenomena *with* the conception. We get the conception of an animal (for instance) by comparing different animals, and when we afterward see a creature resembling an animal, we compare it with our general conception of an animal; and if it agrees with that general conception, we include it in the class. The conception becomes the type of comparison.

And we need only consider what comparison is, to see that where the objects are more than two, and still more when they are an indefinite number, a type of some sort is an indispensable condition of the comparison. When we have to arrange and classify a great number of objects according to their agreements and differences, we do not make a confused attempt to compare all with all. We know that two things are as much as the mind can easily attend to at a time, and we therefore fix upon one of the objects, either at hazard or because it offers in a peculiarly striking manner some important character, and, taking this as our standard, compare it with one object after another. If we find a second object which presents a remarkable agreement with the first, inducing us to class them together, the question instantly arises, in what particular circumstances do they agree? and to take notice of these circumstances is already a first stage of abstraction, giving rise to a general conception. Having advanced thus far, when we now take in hand a third object we naturally ask ourselves the question, not merely whether this third object agrees with the first, but whether it agrees with it in the same circumstances in which the second did? in other words, whether it agrees with the general conception which has been obtained by abstraction from the first and second? Thus we see the tendency of general conceptions, as soon as formed, to substitute themselves as types, for whatever individual objects previously answered that purpose in our comparisons. We may, perhaps, find that no considerable number of other objects agree with this first general conception; and that we must drop the conception, and beginning again with a different individual case, proceed by fresh comparisons to a different general conception. Sometimes, again, we find that the same conception will serve, by merely leaving out some of its circumstances; and by this higher effort of abstraction, we obtain a still more general conception; as in the case formerly referred to, the scientific world rose from the conception of poles to the general conception of opposite properties in opposite directions; or as those South-Sea islanders, whose conception of a quadruped had been abstracted from hogs (the only animals of that description which they had seen), when they afterward compared that conception with other quadrupeds, dropped some of the circumstances, and arrived at the more general conception which Europeans associate with the term.

These brief remarks contain, I believe, all that is well grounded in the doctrine, that the conception by which the mind arranges and gives unity to phenomena must be furnished by the mind itself, and that we find the right conception by a tentative process, trying first one and then another until we hit the mark. The conception is not furnished *by* the mind until it has been furnished *to* the mind; and the facts which supply it are sometimes extraneous facts, but more often the very facts which we are attempting to arrange by it. It is quite true, however, that in endeavoring to arrange the facts, at whatever point we begin, we never advance three steps without forming a general conception, more or less distinct and precise; and that this general conception

becomes the clue which we instantly endeavor to trace through the rest of the facts, or rather, becomes the standard with which we thenceforth compare them. If we are not satisfied with the agreements which we discover among the phenomena by comparing them with this type, or with some still more general conception which by an additional stage of abstraction we can form from the type; we change our path, and look out for other agreements; we recommence the comparison from a different starting-point, and so generate a different set of general conceptions. This is the tentative process which Dr. Whewell speaks of; and which has not unnaturally suggested the theory, that the conception is supplied by the mind itself; since the different conceptions which the mind successively tries, it either already possessed from its previous experience, or they were supplied to it in the first stage of the corresponding act of comparison; so that, in the subsequent part of the process, the conception manifested itself as something compared with the phenomena, not evolved from them.

§ 4. If this be a correct account of the instrumentality of general conceptions in the comparison which necessarily precedes Induction, we are now able to translate into our own language what Dr. Whewell means by saying that conceptions, to be subservient to Induction, must be "clear" and "appropriate."

If the conception corresponds to a real agreement among the phenomena; if the comparison which we have made of a set of objects has led us to class them according to real resemblances and differences; the conception which does this can not fail to be appropriate, for some purpose or other. The question of appropriateness is relative to the particular object we have in view. As soon as, by our comparison, we have ascertained some agreement, something which can be predicated in common of a number of objects; we have obtained a basis on which an inductive process is capable of being founded. But the agreements, or the ulterior consequences to which those agreements lead, may be of very different degrees of importance. If, for instance, we only compare animals according to their color, and class those together which are colored alike, we form the general conceptions of a white animal, a black animal, etc., which are conceptions legitimately formed; and if an induction were to be attempted concerning the causes of the colors of animals, this comparison would be the proper and necessary preparation for such an induction, but would not help us toward a knowledge of the laws of any other of the properties of animals; while if, with Cuvier, we compare and class them according to the structure of the skeleton, or, with Blainville, according to the nature of their outward integuments, the agreements and differences which are observable in these respects are not only of much greater importance in themselves, but are marks of agreements and differences in many other important particulars of the structure and mode of life of the animals. If, therefore, the study of their structure and habits be our object, the conceptions generated by these last comparisons are far more "appropriate" than those generated by the former. Nothing, other than this, can be meant by the appropriateness of a conception.

When Dr. Whewell says that the ancients, or the school-men, or any modern inquirers, missed discovering the real law of a phenomenon because they applied to it an inappropriate instead of an appropriate conception; he can only mean that in comparing various instances of the phenomenon, to ascertain in what those instances agreed, they missed the important points of agreement; and fastened upon such as were either imaginary, and not agreements at all, or, if real agreements, were comparatively trifling, and had no connection with the phenomenon, the law of which was sought.

Aristotle, philosophizing on the subject of motion, remarked that certain motions apparently take place spontaneously; bodies fall to the ground, flame ascends, bubbles of air rise in water, etc.; and these he called natural motions; while others not only never take place without external incitement, but even when such incitement is applied, tend spontaneously to cease; which, to distinguish them from the former, he called violent motions. Now, in comparing the so-called natural motions with one another, it appeared to Aristotle that they agreed in one circumstance, namely, that the body which moved (or seemed to move) spontaneously, was moving *toward its own place*; meaning thereby the place from whence it originally came, or the place where a great quantity of matter similar to itself was assembled. In the other class of motions, as when bodies are thrown up in the air, they are, on the contrary, moving *from* their own place. Now, this conception of a body moving toward its own place may justly be considered inappropriate; because, though it expresses a

circumstance really found in some of the most familiar instances of motion apparently spontaneous, yet, first, there are many other cases of such motion, in which that circumstance is absent; the motion, for instance, of the earth and planets. Secondly, even when it is present, the motion, on closer examination, would often be seen not to be spontaneous; as, when air rises in water, it does not rise by its own nature, but is pushed up by the superior weight of the water which presses upon it. Finally, there are many cases in which the spontaneous motion takes place in the contrary direction to what the theory considers as the body's own place; for instance, when a fog rises from a lake, or when water dries up. The agreement, therefore, which Aristotle selected as his principle of classification, did not extend to all cases of the phenomenon he wanted to study, spontaneous motion; while it did include cases of the absence of the phenomenon, cases of motion not spontaneous. The conception was hence "inappropriate." We may add that, in the case in question, no conception would be appropriate; there is no agreement which runs through all the cases of spontaneous or apparently spontaneous motion and no others; they can not be brought under one law; it is a case of Plurality of Causes.(209)

§ 5. So much for the first of Dr. Whewell's conditions, that conceptions must be appropriate. The second is, that they shall be "clear:" and let us consider what this implies. Unless the conception corresponds to a real agreement, it has a worse defect than that of not being clear: it is not applicable to the case at all. Among the phenomena, therefore, which we are attempting to connect by means of the conception, we must suppose that there really is an agreement, and that the conception is a conception of that agreement. In order, then, that it may be clear, the only requisite is, that we shall know exactly in what the agreement consists; that it shall have been carefully observed, and accurately remembered. We are said not to have a clear conception of the resemblance among a set of objects, when we have only a general feeling that they resemble, without having analyzed their resemblance, or perceived in what points it consists, and fixed in our memory an exact recollection of those points. This want of clearness, or, as it may be otherwise called, this vagueness in the general conception, may be owing either to our having no accurate knowledge of the objects themselves, or merely to our not having carefully compared them. Thus a person may have no clear idea of a ship because he has never seen one, or because he remembers but little, and that faintly, of what he has seen. Or he may have a perfect knowledge and remembrance of many ships of various kinds, frigates among the rest, but he may have no clear but only a confused idea of a frigate, because he has never been told, and has not compared them sufficiently to have remarked and remembered, in what particular points a frigate differs from some other kind of ship.

It is not, however, necessary, in order to have clear ideas, that we should know all the common properties of the things which we class together. That would be to have our conception of the class complete as well as clear. It is sufficient if we never class things together without knowing exactly why we do so--without having ascertained exactly what agreements we are about to include in our conception; and if, after having thus fixed our conception, we never vary from it, never include in the class any thing which has not those common properties, nor exclude from it any thing which has. A clear conception means a determinate conception; one which does not fluctuate, which is not one thing to-day and another to-morrow, but remains fixed and invariable, except when, from the progress of our knowledge, or the correction of some error, we consciously add to it or alter it. A person of clear ideas is a person who always knows in virtue of what properties his classes are constituted; what attributes are connoted by his general names.

The principal requisites, therefore, of clear conceptions, are habits of attentive observation, an extensive experience, and a memory which receives and retains an exact image of what is observed. And in proportion as any one has the habit of observing minutely and comparing carefully a particular class of phenomena, and an accurate memory for the results of the observation and comparison, so will his conceptions of that class of phenomena be clear; provided he has the indispensable habit (naturally, however, resulting from those other endowments), of never using general names without a precise connotation.

As the clearness of our conceptions chiefly depends on the *carefulness* and *accuracy* of our observing and comparing faculties, so their appropriateness, or rather the chance we have of hitting upon the appropriate conception in any case, mainly depends on the *activity* of the same faculties. He who by habit, grounded on

sufficient natural aptitude, has acquired a readiness in accurately observing and comparing phenomena, will perceive so many more agreements, and will perceive them so much more rapidly than other people, that the chances are much greater of his perceiving, in any instance, the agreement on which the important consequences depend.

§ 6. It is of so much importance that the part of the process of investigating truth, discussed in this chapter, should be rightly understood, that I think it is desirable to restate the results we have arrived at, in a somewhat different mode of expression.

We can not ascertain general truths, that is, truths applicable to classes, unless we have formed the classes in such a manner that general truths can be affirmed of them. In the formation of any class, there is involved a conception of it as a class, that is, a conception of certain circumstances as being those which characterize the class, and distinguish the objects composing it from all other things. When we know exactly what these circumstances are, we have a clear idea (or conception) of the class, and of the meaning of the general name which designates it. The primary condition implied in having this clear idea, is that the class be really a class; that it correspond to a real distinction; that the things it includes really do agree with one another in certain particulars, and differ, in those same particulars, from all other things. A person without clear ideas is one who habitually classes together, under the same general names, things which have no common properties, or none which are not possessed also by other things; or who, if the usage of other people prevents him from actually misclassing things, is unable to state to himself the common properties in virtue of which he classes them rightly.

But is it not the sole requisite of classification that the classes should be real classes, framed by a legitimate mental process? Some modes of classing things are more valuable than others for human uses, whether of speculation or of practice; and our classifications are not well made, unless the things which they bring together not only agree with each other in something which distinguishes them from all other things, but agree with each other and differ from other things in the very circumstances which are of primary importance for the purpose (theoretical or practical) which we have in view, and which constitutes the problem before us. In other words, our conceptions, though they may be clear, are not *appropriate* for our purpose, unless the properties we comprise in them are those which will help us toward what we wish to understand--*i.e.*, either those which go deepest into the nature of the things, if our object be to understand that, or those which are most closely connected with the particular property which we are endeavoring to investigate.

We can not, therefore, frame good general conceptions beforehand. That the conception we have obtained is the one we want, can only be known when we have done the work for the sake of which we wanted it; when we completely understand the general character of the phenomena, or the conditions of the particular property with which we concern ourselves. General conceptions formed without this thorough knowledge, are Bacon's "notiones temerè à rebus abstractæ." Yet such premature conceptions we must be continually making up, in our progress to something better. They are an impediment to the progress of knowledge, only when they are permanently acquiesced in. When it has become our habit to group things in wrong classes--in groups which either are not really classes, having no distinctive points of agreement (absence of *clear* ideas), or which are not classes of which any thing important to our purpose can be predicated (absence of *appropriate* ideas); and when, in the belief that these badly made classes are those sanctioned by nature, we refuse to exchange them for others, and can not or will not make up our general conceptions from any other elements; in that case all the evils which Bacon ascribes to his "notiones temerè abstractæ" really occur. This was what the ancients did in physics, and what the world in general does in morals and politics to the present day.

It would thus, in my view of the matter, be an inaccurate mode of expression to say, that obtaining appropriate conceptions is a condition precedent to generalization. Throughout the whole process of comparing phenomena with one another for the purpose of generalization, the mind is trying to make up a conception; but the conception which it is trying to make up is that of the really important point of agreement in the phenomena. As we obtain more knowledge of the phenomena themselves, and of the conditions on which

their important properties depend, our views on this subject naturally alter; and thus we advance from a less to a more "appropriate" general conception, in the progress of our investigations.

We ought not, at the same time, to forget that the really important agreement can not always be discovered by mere comparison of the very phenomena in question, without the aid of a conception acquired elsewhere; as in the case, so often referred to, of the planetary orbits.

The search for the agreement of a set of phenomena is in truth very similar to the search for a lost or hidden object. At first we place ourselves in a sufficiently commanding position, and cast our eyes round us, and if we can see the object it is well; if not, we ask ourselves mentally what are the places in which it may be hid, in order that we may there search for it: and so on, until we imagine the place where it really is. And here too we require to have had a previous conception, or knowledge, of those different places. As in this familiar process, so in the philosophical operation which it illustrates, we first endeavor to find the lost object or recognize the common attribute, without conjecturally invoking the aid of any previously acquired conception, or, in other words, of any hypothesis. Having failed in this, we call upon our imagination for some hypothesis of a possible place, or a possible point of resemblance, and then look to see whether the facts agree with the conjecture.

For such cases something more is required than a mind accustomed to accurate observation and comparison. It must be a mind stored with general conceptions, previously acquired, of the sorts which bear affinity to the subject of the particular inquiry. And much will also depend on the natural strength and acquired culture of what has been termed the scientific imagination; on the faculty possessed of mentally arranging known elements into new combinations, such as have not yet been observed in nature, though not contradictory to any known laws.

But the variety of intellectual habits, the purposes which they serve, and the modes in which they may be fostered and cultivated, are considerations belonging to the Art of Education: a subject far wider than Logic, and which this treatise does not profess to discuss. Here, therefore, the present chapter may properly close.