

I

THE NATURE AND IMPORTANCE OF THE POSITIVE PHILOSOPHY

In order to explain properly the true nature and peculiar character of the positive philosophy, it is indispensable that we should first take a brief survey of the progressive growth of the human mind viewed as a whole; for no idea can be properly understood apart from its history.

In thus studying the total development of human intelligence in its different spheres of activity, from its first and simplest beginning up to our own time, I believe that I have discovered a great fundamental law, to which the mind is subjected by an invariable necessity. The truth of this law can, I think, be demonstrated both by reasoned proofs furnished by a knowledge of our mental organization, and by historical verification due to an attentive study of the past. This law consists in the fact that each of our principal conceptions, each branch of our knowledge, passes in succession through three different theoretical states: the theological or fictitious state, the metaphysical or abstract state, and the scientific or positive state. In other words, the human mind—by its very nature—makes use successively in each of its researches of three methods of philosophizing, whose characters are essentially different and even radically opposed to

each other. We have first the theological method, then the metaphysical method, and finally the positive method. Hence, there are three kinds of philosophy or general systems of conceptions on the aggregate of phenomena which are mutually exclusive of each other. The first is the necessary starting point of human intelligence; the third represents its fixed and definitive state; the second is destined to serve only as a transitional method.

In the theological state, the human mind directs its researches mainly toward the inner nature of beings, and toward the first and final causes of all the phenomena that it observes—in a word, toward absolute knowledge. It therefore represents these phenomena as being produced by the direct and continuous action of more or less numerous supernatural agents, whose arbitrary intervention explains all the apparent anomalies of the universe. //

In the metaphysical state, which is in reality only a simple general modification of the first state, the supernatural agents are replaced by abstract forces, real entities or personified abstractions, inherent in the different beings of the world. These entities are looked upon as capable of giving rise by themselves to all the phenomena observed, each phenomenon being explained by assigning it to its corresponding entity. //

Finally, in the positive state, the human mind, recognizing the impossibility of obtaining absolute truth, gives up the search after the origin and hidden causes of the universe and a knowledge of the final causes of phenomena. It endeavours now only to discover, by a well-combined use of reasoning and observation, the actual laws of phenomena—that is to say, their invariable relations of succession and likeness. The explanation of facts, thus reduced to its real terms, consists henceforth only in the connection established between different particular phenomena and some general facts, the number of which the progress of science tends more and more to diminish.

The theological system arrived at its highest form of perfection when it substituted the providential action of a single being for the varied play of the numerous independent gods which had been imagined by the primitive mind. In the same way, the last stage of the metaphysical system consisted in replacing the dif-

ferent special entities by the idea of a single great general entity—nature—looked upon as the sole source of all phenomena. Similarly, the ideal of the positive system, toward which it constantly tends, although in all probability it will never attain such a stage, would be reached if we could look upon all the different phenomena observable as so many particular cases of a single general fact, such as that of gravitation, for example.

This is not the place to give a special demonstration of this fundamental law of mental development, and to deduce from it its most important consequences. We shall make a direct study of it, with all the necessary details, in the part of this work relating to social phenomena.¹ I am considering it now only in order to determine precisely the true character of the positive philosophy, as opposed to the two other philosophies which have successively dominated our whole intellectual system up to these latter centuries. For the present, to avoid leaving entirely undemonstrated so important a law, the applications of which frequently occur throughout this work, I must confine myself to a rapid enumeration of the most evident general reasons that prove its exactitude.

In the first place, it is, I think, sufficient merely to enunciate such a law for its accuracy to be immediately verified by all those who are fairly well acquainted with the general history of the sciences. For there is not a single science that has today reached the positive stage, which was not in the past—as each can easily see for himself—composed mainly of metaphysical abstractions, and, going back further still, it was altogether under

¹ Readers who desire to have a fuller explanation of this subject, without delay, may consult with advantage three articles entitled "Philosophical Considerations on the Sciences and Men of Science," which I published in November, 1825, in a journal called the *Producteur* (numbers seven, eight, and ten), and especially the first part of my *System of Positive Polity*, addressed in April, 1824, to the Academy of Sciences, where I placed on record for the first time my discovery of this law.

[This note appears in the original text. All other notes have been added by the editor.]

the sway of theological conceptions. Unfortunately, we shall have to recognize on more than one occasion in the different parts of this course, that even the most perfect sciences retain today some very evident traces of these two primitive states.

This general revolution of the human mind can, moreover, be easily verified today in a very obvious, although indirect, manner, if we consider the development of the individual intelligence. The starting point being necessarily the same in the education of the individual as in that of the race, the various principal phases of the former must reproduce the fundamental epochs of the latter. Now, does not each of us in contemplating his own history recollect that he has been successively—as regards the most important ideas—a theologian in childhood, a metaphysician in youth, and a natural philosopher in manhood? This verification of the law can easily be made by all who are on a level with their era.

But in addition to the proofs of the truth of this law furnished by direct observation of the race or the individual, I must, above all, mention in this brief summary the theoretical considerations that show its necessity.

The most important of these considerations arises from the very nature of the subject itself. It consists in the need at every epoch of having some theory to connect the facts, while, on the other hand, it was clearly impossible for the primitive human mind to form theories based on observation.

All competent thinkers agree with Bacon² that there can be no real knowledge except that which rests upon observed facts. This fundamental maxim is evidently indisputable if it is applied, as it ought to be, to the mature state of our intelligence. But, if we consider the origin of our knowledge, it is no less certain that the primitive human mind could not and, indeed, ought not to have thought in that way. For if, on the one hand, every positive theory must necessarily be founded upon observations, it is, on

² Francis Bacon (1561–1626), English philosopher largely responsible for laying the modern foundations of experimentalism in science and resolute empiricism in philosophy.

the other hand, no less true that, in order to observe, our mind has need of some theory or other. If in contemplating phenomena we did not immediately connect them with some principles, not only would it be impossible for us to combine these isolated observations and, therefore, to derive any profit from them, but we should even be entirely incapable of remembering the facts, which would for the most part remain unnoted by us. //

Thus, there were two difficulties to be overcome: the human mind had to observe in order to form real theories; and yet it had to form theories of some sort before it could apply itself to a connected series of observations. The primitive human mind, therefore, found itself involved in a vicious circle, from which it would never have had any means of escaping if a natural way out of the difficulty had not fortunately been found by the spontaneous development of theological conceptions. These presented a rallying point for the efforts of the mind, and furnished materials for its activity. This is the fundamental motive which demonstrates the logical necessity for the purely theological character of primitive philosophy, apart from those important social considerations relating to the matter which I cannot even indicate now.

This necessity becomes still more evident when we regard the perfect congruity of theological philosophy with the peculiar nature of the researches on which the human mind in its infancy concentrated to so high a degree all its efforts. It is, indeed, very noticeable that the most insoluble questions—such as the inner nature of objects, or the origin and purpose of all phenomena—are precisely those which the human mind proposes to itself, in preference to all others, in its primitive state, all really soluble problems being looked upon as hardly worthy of serious thought. The reason for this is very obvious, since it is experience alone that has enabled us to estimate our abilities rightly, and, if man had not commenced by overestimating his forces, these would never have been able to acquire all the development of which they are capable. This fact is a necessity of our organization. But, be that as it may, let us picture to ourselves as far as we are able this [early] mental disposition, so universal and so prominent,

and let us ask ourselves what kind of reception would have been accorded at such an epoch to the positive philosophy, supposing it to have been then formed. The highest ambition of this philosophy is to discover the laws of phenomena, and its main characteristic is precisely that of regarding as necessarily interdicted to the human reason all those sublime mysteries which theological philosophy, on the contrary, explains with such admirable facility, even to the smallest detail. [Under such circumstances, it is easy to see what the choice of primitive man would be.]

The same thing is true when we consider from a practical standpoint the nature of the pursuits with which the human mind first occupies itself. Under that aspect they offer to man the strong attraction of an unlimited control over the exterior world, which is regarded as being entirely destined for our use, while all its phenomena seem to have close and continuous relations with our existence. These chimerical hopes, these exaggerated ideas of man's importance in the universe, to which the theological philosophy gives rise, are destroyed irrevocably by the first fruits of the positive philosophy. But at the beginning they afforded an indispensable stimulus without the aid of which we cannot, indeed, conceive how the primitive human mind would have been induced to undertake any arduous labors.

We are at the present time so far removed from that early state of mind—at least as regards the majority of phenomena—that it is difficult for us to appreciate properly the force and necessity of such considerations. Human reason is now so mature that we are able to undertake laborious scientific researches without having in view any extraneous goal capable of strongly exciting the imagination, such as that which the astrologers or alchemists proposed to themselves. Our intellectual activity is sufficiently excited by the mere hope of discovering the laws of phenomena, by the simple desire of verifying or disproving a theory. This, however, could not be the case in the infancy of the human mind. Without the attractive chimeras of astrology, or the powerful deceptions of alchemy, for example, where should we have found the perseverance and ardor necessary for collecting the long series of observations and experiments which

later on served as a basis for the first positive theories of these two classes of phenomena?

The need for such a stimulus to our intellectual development was keenly felt long ago by Kepler³ in the case of astronomy, and has been justly appreciated in our own time by Berthollet⁴ in chemistry.

The above considerations show us that, although the positive philosophy represents the true final state of human intelligence—that to which it has always tended more and more—it was nonetheless necessary to employ the theological philosophy at first and during many centuries, both as a method and as furnishing provisional doctrines. Because the theological philosophy was spontaneous in its character, it was the only one possible in the beginning; it was also the only one to offer a sufficient interest to our budding intelligence. It is now very easy to see that, in order to pass from this provisional form of philosophy to the final stage, the human mind was naturally obliged to adopt metaphysical methods and doctrines as a transitional form of philosophy. This last consideration is indispensable in order to complete the general sketch of the great law which I have pointed out.

It is easily seen that our understanding, [which was] compelled to progress by almost insensible steps, could not pass suddenly and without any intermediate stages from theological to positive philosophy. Theology and physics are so profoundly incompatible, their conceptions are so radically opposed in character, that, before giving up the one in order to employ the other exclusively, the human intelligence had to make use of intermediate conceptions, which, being of a hybrid character, were eminently fitted to bring about a gradual transition. That is the

³ Johann Kepler (1571–1630) German astronomer and mathematician, one of the principal founders of modern astronomy through the mathematical formulation of the laws of planetary motion.

⁴ Claude Louis Berthollet (1748–1822) French chemist who, with Antoine Lavoisier (1743–1794) reformed modern chemical nomenclature and thus helped to found the modern science of chemistry.

part played by metaphysical conceptions, and they have no other real use. By substituting, in the study of phenomena, a corresponding inseparable entity for a direct supernatural agency—although at first the former was only held to be an offshoot of the latter—man gradually accustomed himself to consider only the facts themselves. This development was caused by the concepts of metaphysical agents gradually becoming so empty through oversubtle qualification that all right-minded persons considered them to be only the abstract names of the phenomena in question. It is impossible to imagine by what other method our understanding could have passed from frankly supernatural to purely natural considerations, or, in other words, from the theological to the positive régime.

I have thus established, insofar as it is possible without entering into a special discussion, which would be out of place at the present moment, that which I conceive to be the general law of mental development. It will now be easy for us to determine precisely the exact nature of the positive philosophy. To do that is the special object of this chapter.

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We have seen that the fundamental character of the positive philosophy is to consider all phenomena as subject to invariable natural laws. The exact discovery of these laws and their reduction to the least possible number constitute the goal of all our efforts; for we regard the search after what are called causes, whether first or final, as absolutely inaccessible and unmeaning. It is unnecessary to dwell much on a principle that has now become so familiar to all who have made anything like a serious study of the observational sciences. Everybody, indeed, knows that in our positive explanations, even when they are most complete, we do not pretend to explain the real causes of phenomena, as this would merely throw the difficulty further back; we try only to analyze correctly the circumstances of their production, and to connect them by normal relations of succession and similarity.

Thus, to cite the best example, we say that the general phenomena of the universe are explained—as far as they can be—by the Newtonian law of gravitation. On the one hand, this ad-

mirable theory shows us all the immense variety of astronomical facts as only a single fact looked at from different points of view, that fact being the constant tendency of all molecules towards each other in direct proportion to their masses and inversely as the squares of their distances. On the other hand, this general fact is shown to be the simple extension of an extremely familiar and, therefore, well-known phenomenon—the weight of a body at the earth's surface. As to determining what attraction and weight are in themselves, or what their causes are—these are questions which we regard as insoluble and outside the domain of the positive philosophy; we, therefore, rightly abandon them to the imagination of the theologians or the subtleties of the metaphysicians. That it is clearly impossible to solve such questions is shown by the fact that, whenever an attempt has been made to give a rational explanation of the matter, the greatest thinkers have only been able to define one of these principles by the other. Attraction is defined as nothing but universal weight, and weight is said to consist simply in terrestrial attraction. Explanations of this kind raise a smile, if put forward as furnishing us with a knowledge of “things-in-themselves” and the mode of causation of phenomena. They are, however, the only satisfactory results obtainable, for they present as identical two orders of phenomena which for so long a time were regarded as unconnected. No sensible person would nowadays seek to go beyond this.

It would be easy to multiply these examples, which will occur very frequently throughout this treatise, for at the present day all great intellectual operations are conducted in this spirit. To take a single example of this from contemporary works, I will choose the fine series of researches made by Fourier⁵ on the theory of heat. This affords us an excellent verification of the preceding general remarks. In this work, the philosophical character of which is so eminently positive, the most important and most precise laws of thermal phenomena are disclosed; but the

⁵ Jean Baptiste Joseph Fourier (1768–1830), French mathematician and physicist. Probably in the private audience to which these remarks were first addressed.

author has not once inquired into the intimate nature of heat itself, nor has he mentioned, except to point out its uselessness, the vigorous controversy between the partisans of heat as a material substance and those who make it consist in the vibrations of a universal ether. Yet, that work treats of the most important questions, several of which had never been raised—a clear proof that the human mind, by simply confining itself to researches of an entirely positive order, can find therein inexhaustible food for its highest form of activity without attacking inaccessible problems.

Having thus indicated, insofar as it was possible in this general sketch, the spirit of the positive philosophy, which the whole of this course is intended to develop, we must next consider what stage in the formation of that philosophy has now been reached and what remains to be done in order to constitute it fully.

For this purpose, we must in the first place remember that the different branches of our knowledge were not able to pass at the same rate through the three great phases of their development indicated above, and that consequently they did not arrive simultaneously at the positive state. There exists in this respect an invariable and necessary order that our various classes of conceptions have followed, and were bound to follow, in their progressive course; and the exact consideration of this order is the indispensable complement of the fundamental mental law previously enunciated. That order will form the special subject of the next chapter. At present it is sufficient to know that it conforms to the diverse nature of the phenomena, and that it is determined by their degree of generality, of simplicity, and of reciprocal independence—three considerations which, although quite distinct, lead to the same result. Thus, astronomical phenomena, being the most general, the simplest, and the most independent of all others, were the first to be subjected to positive theories; then followed in succession and for the same reasons the phenomena of terrestrial physics, properly so called, those of chemistry, and, finally, those of physiology.

It is impossible to fix the precise date of this mental revolution; we can say only that, like all other great human events, it

took place continuously and at an increasing rate, especially since the labors of Aristotle and the Alexandrian school, and afterward from the introduction of natural science into the west of Europe by the Arabs. However, as it is better to fix an epoch in order to give greater precision to our ideas, I would select that of the great movement imparted to the human intellect two centuries ago by the combined influence of the precepts of Bacon,⁶ the conceptions of Descartes,⁷ and the discoveries of Galileo.⁸ It was then that the spirit of the positive philosophy began to assert itself in the world, in evident opposition to the theological and metaphysical spirit; for it was then that positive conceptions disengaged themselves clearly from the superstitious and scholastic alloy, which had more or less disguised the true character of all the previous scientific work.

Since that memorable epoch, the increasing influence of the positive philosophy and the decadent movement of theological and metaphysical philosophy have been extremely marked. These movements have at last become so pronounced that at the present day it is impossible for any observer acquainted with the spirit of his age to fail to recognize the final bent of the human mind toward positive studies, and the irrevocable break henceforth from those fruitless doctrines and provisional methods that were suited only to its first flight. This fundamental mental revolution will, therefore, necessarily be carried out to the fullest extent. If, then, there still remains some great conquest to be made, some important division of the intellectual domain to be invaded, we can be certain that the transformation will take place there also,

⁶ See page 4, note 2.

⁷ René Descartes (1596–1650), French philosopher and mathematician, largely responsible for shaping the problems of modern philosophy and for emphasizing the rational, mathematical, and theoretical aspects of science and philosophy.

⁸ Galileo Galilei (1564–1642), Italian physicist and astronomer, whose combination of inductive with deductive ways of thinking (uniting Bacon and Descartes, as it were) founded the methodology of modern science, and whose discoveries in various fields provided tremendous impetus to early modern science.

as it has been carried out in all the other branches of science. It would evidently be absurd to suppose that the human mind, which is so disposed to unity of method, would yet preserve indefinitely, in the case of a single class of phenomena, its primitive mode of philosophizing, when it has once adopted for the other classes a new philosophic path of an entirely opposite character.

The whole thing reduces itself, therefore, to a simple question of fact: Does the positive philosophy, which during the last two centuries has gradually acquired so great an extension, embrace at the present day all classes of phenomena? It is evident that it does not; therefore, a great scientific work still remains to be executed in order to give the positive philosophy that universal character indispensable for its final constitution. //

In the four principal categories of natural phenomena enumerated above—astronomical, physical, chemical, and physiological—we notice an important omission relating to social phenomena. Although these are implicitly comprised among physiological phenomena, yet, owing to their importance and the inherent difficulties of their study, they deserve to form a distinct class. This last order of ideas is concerned with the most special, most complicated, and most dependent of all phenomena; it has, therefore, necessarily progressed more slowly than all the preceding orders, even if we do not take into account the more special obstacles to its study which we shall consider later on. However that may be, it is evident that it has not yet been included within the domain of positive philosophy. Theological and metaphysical methods are never used now by anyone in dealing with all the other kinds of phenomena, either as a means of investigation or even as a mode of reasoning. But these discarded methods are, on the contrary, still used exclusively for both purposes in everything that concerns social phenomena, although their insufficiency in this respect has been fully felt already by all good minds, such men being tired of these empty and endless discussions between, e.g., divine right and the sovereignty of the people. //

Here, then, is the great, but evidently the only, gap that has

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to be filled in order to finish the construction of the positive philosophy. Now that the human mind has founded celestial physics, terrestrial physics (mechanical and chemical), and organic physics (vegetable and animal), it only remains to complete the system of observational sciences by the foundation of social physics.⁹ This is at the present time, under several important aspects, the greatest and most pressing of our cognitive needs, and to meet this need is, I make bold to say, the first purpose of this work, its special object.

The conceptions which I shall endeavor to present relating to the study of social phenomena, and of which I hope the present chapter has already enabled us to see the germ, cannot be expected to raise social physics at once to the degree of perfection that has been reached by the earlier branches of natural philosophy. Such a hope would be evidently chimerical, seeing that these branches still differ widely from one another in perfectness, as was, indeed, inevitable. But I aim at impressing upon this last branch of our knowledge the same positive character that already marks all the other branches. If this condition is once really fulfilled, the philosophical system of the modern world will be founded at last in its entirety; for there is no observable fact that would not then be included in one or another of the five great categories of astronomical, physical, chemical, physiological, and social phenomena. All our fundamental conceptions having thus been rendered homogeneous, philosophy will be constituted finally in the positive state. Its character will be henceforth unchangeable, and it will then have only to develop itself indefinitely, by incorporating the constantly increasing knowledge that inevitably results from new observations or more profound meditations. Having by this means acquired the character of universality which as yet it lacks, the positive phi-

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⁹ Comte invented the term "sociology," meant to designate the rigorous study of social phenomena according to the precepts of positive philosophy. But since here Comte is clearly attempting to show the parallels between the various fields of science, his expression "social physics" will be retained.

losophy, with all its natural superiority, will be able to displace entirely the theological and metaphysical philosophies. The only real property possessed by theology and metaphysics at the present day is their character of universality, and when deprived of this motive for preference they will have for our successors only a historical interest.

The first and special object of this course having been thus set forth, it is easy to comprehend its second and general aim, that which constitutes it a course of positive philosophy, and not merely a course on social physics.

The formation of social physics at last completes the system of natural sciences. It, therefore, becomes possible and even necessary to summarize these different sciences, so that they may be coordinated by presenting them as so many branches of a single trunk, instead of continuing to look upon them as only so many isolated groups. Therefore, before proceeding to the study of social phenomena, I shall successively consider, in the encyclopedic order given above, the different positive sciences already formed.

It is, I think, unnecessary to warn the reader that I do not claim to give here a series of special courses of lectures on each of the principal branches of natural philosophy. Not to speak of the enormous time that such an enterprise would take, it is clear that I cannot claim to be equipped for it, nor, I think I may add, can anyone else in the present state of human education. On the contrary, a course of the kind contemplated here requires, if it is to be understood properly, a previous series of special studies on the different sciences which will be treated therein. In the absence of this condition, it is very difficult to realize, and impossible to estimate, the philosophical reflections that will be made upon these sciences. In one word, it is a course on positive philosophy, and not on the positive sciences, that I propose to give. We shall have to consider here only each fundamental science in its relations with the whole positive system and the spirit characterizing it; that is to say, under the twofold aspect of

its essential methods and its principal achievements. As to the achievements, indeed, I shall often do no more than mention them as known to specialists, though I shall try to estimate their importance.

In order to sum up the ideas relating to the twofold purpose of this course, I must call attention to the two objects—the one special, the other general—that I have in view and that, although distinct in themselves, are necessarily inseparable. On the one hand, it would be impossible to conceive of a course of positive philosophy unless social physics had been founded first, since an essential element would then be lacking; consequently, the conceptions of such a course would not have that character of generality that ought to be their principal attribute and that distinguishes our present study from any series of special studies. On the other hand, how can we proceed with sure step to the positive study of social phenomena if the mind has not been prepared first by the thorough consideration of positive methods in the case of less complex phenomena, and furnished in addition with a knowledge of the principal laws of earlier phenomena, all of which have a more or less direct influence upon social facts?

Although all the fundamental sciences do not inspire ordinary minds with an equal interest, there is not one of them that should be neglected in such a study as we are about to undertake. As regards the welfare of the human race, all of them are certainly of equal importance when we examine them thoroughly. Besides, those whose results seem at first sight to offer only a minor practical interest are yet of the greatest importance, owing to either the greater perfection of their methods or the indispensable foundation of all the others. This is a consideration to which I shall have special occasion to refer in the next chapter.

To guard as far as possible against the misconceptions likely to arise respecting a work as novel as this, I must add a few remarks to the explanations already given. I refer especially to that universal predominance of specialism, which hasty readers might think was the tendency of this course, and which is so rightly

looked upon as wholly contrary to the true spirit of the positive philosophy. These remarks, moreover, will have the more important advantage of exhibiting this spirit under a new aspect, calculated to make its general idea clearer.

In the primitive state of our knowledge, no regular division exists among intellectual labors; all the sciences are cultivated simultaneously by the same minds. This method of organizing human studies is at first inevitable and even indispensable, as I shall have occasion to show later on; but it gradually changes in proportion as the different orders of conceptions develop themselves. By a law whose necessity is evident, each branch of the scientific system gradually separates from the trunk when it has developed far enough to admit of separate cultivation—that is to say, when it has arrived at a stage in which it is capable of constituting the sole pursuit of certain minds. It is to this division of the various kinds of research among different orders of scientists that we evidently owe the development which each distinct class of human knowledge has attained in our time; but this very division renders it impossible for modern scientists to practice that simultaneous cultivation of all the sciences which was so easy and so common in antiquity. In a word, the division of intellectual labor, carried out further and further, is one of the most important and characteristic attributes of the positive philosophy. //

But, while recognizing the prodigious results due to this division, and while seeing that it henceforth constitutes the true fundamental basis of the general organization of the scientific world, it is, on the other hand, impossible not to be struck by the great inconveniences which it at present produces, because of the excessive specialization of the ideas that exclusively occupy each mind. This unfortunate result, being inherent in the very principle of the division of labor, is no doubt inevitable up to a certain point. Do what we will, therefore, we shall never be able to equal the ancients in this respect, for their general superiority was due to the slight degree of development of their knowledge. Yet, I think we can, by proper means, avoid the most pernicious effects of an exaggerated specialism without doing

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injury to the fruitful influence of the division of labor in research. There is an urgent need to consider this question seriously, for these inconveniences, which by their very nature tend constantly to increase, are now becoming very apparent. Everyone agrees that the divisions which we establish between the various branches of natural philosophy, in order to make our labors more perfect, are at bottom artificial. In spite of this admission, we must not forget that the number of scientists who study the whole of even a single science is already very small, although such a science is, in its turn, only a part of a greater whole. The majority of scientists already confine themselves entirely to the isolated consideration of a more or less extensive section of a particular science, without concerning themselves much about the relationship between their special work and the general system of positive knowledge. Let us hasten to remedy this evil before it becomes more serious. Let us take care that the human mind does not lose its way in a mass of detail. We must not conceal from ourselves that this is the essentially weak side of our system, and that this is the point on which the partisans of theological and metaphysical philosophy may still attack the positive philosophy with some hope of success.

The true means of arresting the pernicious influence that seems to threaten the intellectual future of mankind, because of too great a specialization of individual researches, is clearly not to return to the ancient confusion of labors. This would tend to put the human mind back; and, besides, such a return has happily become impossible now. The true remedy consists, on the contrary, in perfecting the division of labor itself. All that is necessary is to create one more great speciality, consisting in the study of general scientific traits. We need a new class of properly trained scientists who, instead of devoting themselves to the special study of any particular branch of science, shall employ themselves solely in the consideration of the different positive sciences in their present state. It would be their function to determine exactly the character of each science, to discover the relations and concatenation of the sciences, and to reduce, if possible, all their chief principles to the smallest number of com-

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mon principles, while always conforming to the fundamental maxims of the positive method. At the same time the other scientists, before devoting themselves to their respective specialties, should have received a previous training embracing all the general principles of positive knowledge. This would enable them henceforth to make immediate use of the light thrown on their work by the scientists devoted to the study of the sciences in general, whose results the specialists would in turn be able to rectify. That is a state of things to which the existing scientists are drawing nearer every day. If these two great conditions were once fulfilled, as they evidently can be, then the division of labor in the sciences could be carried on without any danger as far as the development of the different kinds of knowledge required. There would be a distinct class of men [always open to the critical discipline of all the other classes], whose special and permanent function would consist in connecting each new special discovery with the general system; and we should then have no cause to fear that too great an attention bestowed upon the details would ever prevent us from perceiving the whole. In a word, the modern organization of the scientific world would then be accomplished, and would be susceptible of indefinite development, while always preserving the same character.

To make the study of the universal characteristics of the sciences a distinct department of intellectual labor is merely a further extension of the same principle of division that led to the successive separation of the different sciences. As long as the different positive sciences were only slightly developed, their mutual relations were not important enough to give rise (at all events permanently) to a special discipline, nor was the need of this new study nearly as urgent as it is now. But at the present day each of the sciences has developed on its own lines to such an extent that the examination of a mutual relationship affords material for systematic and continued labor, while at the same time this new order of studies becomes indispensable to prevent the dispersion of human ideas.

Such, in my view, is the office of the positive philosophy in

relation to the positive sciences, properly so called. Such, at all events, is the aim of the present work.

I have now determined, as exactly as possible in a first sketch, the general spirit of a course of positive philosophy. In order to bring out its full character, I must state concisely the principal general advantages that such a work may have—if its essential conditions are fulfilled properly—as regards intellectual progress. I will mention only four. They are fundamental qualities of the positive philosophy.

In the first place, the study of the positive philosophy, by considering the results of the activity of our intellectual faculties, furnishes us with the only really rational means of exhibiting the logical laws of the human mind, which have hitherto been sought by methods so ill calculated to reveal them.

To explain what I mean on this point I must first recall a philosophical conception of the highest importance, set forth by Blainville¹⁰ in the fine introduction to his *Principles of Comparative Anatomy*. According to him, every active being, and especially every living being, may be studied in all its manifestations under two fundamental relations—the static and the dynamic; that is, as fitted to act and as actually acting. It is clear that all the considerations which might be presented will necessarily fall under the one or the other of these heads. Let us apply this luminous fundamental maxim to the study of intellectual functions.

If these functions are regarded from a static point of view, their study can consist only in determining the organic conditions on which they depend; it thus forms an essential part of anatomy and physiology. When considering the question from a dynamic point of view, we have merely to study the actual march of the human intellect, in practice, by examining the procedures used by it in order to acquire a knowledge of the various

¹⁰ Henri Marie Ducrotay de Blainville (1778–1850), French naturalist. Probably in the private audience to which these remarks were first addressed.

sciences; this constitutes essentially the general object of the positive philosophy as I have already defined it in this chapter. In brief, we must look upon all scientific theories as so many great logical facts; and it is only by a thorough observation of these facts that we can rise to the knowledge of logical laws. /

These are evidently the only two general methods, complementary to each other, by the use of which we are able to arrive at any really rational ideas concerning intellectual phenomena. We see that in no case is there room for that illusory psychology—the last transformation of theology—the revival of which attempts are being made so vainly at the present day. This theory, while ignoring and discarding the physiological study of our intellectual organs and the observation of the rational methods that actually direct our various scientific researches, claims that it can discover the fundamental laws of the human mind, by contemplating it in itself, without paying any attention to either the causes or the effects of its activity.

The preponderance of the positive philosophy has been growing steadily since Bacon's time. It has today acquired, indirectly, so great a hold over even those minds that are the least familiar with its immense development that the metaphysicians devoted to the study of the intellect could only hope to check the decadence of their pretended science by presenting their doctrines as also being founded upon the observation of facts. In order to do this, they have recently attempted to distinguish, by a very singular subtlety, two kinds of observation of equal importance, the one exterior, the other interior, the latter being devoted solely to the study of intellectual phenomena. To enter into a special discussion of this fundamental sophism would be out of place here. I must be content with indicating the principal consideration which proves clearly that this pretended direct contemplation of the mind by itself is a pure illusion.

It was thought until quite recently that vision was explained by saying that the luminous action of bodies produces on the retina actual images representing exterior forms and colors. To this the physiologists have reasonably objected that, if the luminous impressions produced real images on the retina, we should

need another eye to see them. Is not this reasoning still more applicable in the present instance?

It is clear that, by an inevitable necessity, the human mind can observe all phenomena directly, except its own. Otherwise, by whom would the observation be made? As far as moral phenomena are concerned, it may be granted that it is possible for a man to observe the passions that animate him, for the anatomical reason that the organs which are their seat are distinct from those whose functions are devoted to observation. Everyone has had occasion to notice this fact for himself, but such observations would evidently never possess much scientific value. The best way of knowing the passions will always be to observe them from the outside; for a person in any state of extreme passion—that is to say, in precisely the state that it is most essential to examine—would necessarily be incapacitated for observing himself. But in the case of intellectual phenomena, to observe them in this manner while they are taking place is clearly out of the question. The thinking individual cannot cut himself in two—one of the parts reasoning, while the other is looking on. Since in this case the organ observed and the observing organ are identical, how could any observation be made?

The principle of this so-called psychological method is therefore entirely worthless. Besides, consider to what thoroughly contradictory proceedings it immediately leads! On the one hand, you are recommended to isolate yourself as far as possible from the outer world, and you must especially give up all intellectual work; for if you were engaged in making only the simplest calculation, what would become of the interior observation? On the other hand, after having, by means of due precautions, at last attained this perfect state of intellectual slumber, you must then occupy yourself in contemplating the operations that will be taking place in a mind supposed to be blank! Our descendants will no doubt see such pretensions ridiculed on the stage some day.

The results of such a strange procedure are in thorough accordance with the principle. For the last two thousand years, metaphysicians have been cultivating psychology in this man-

ner, and yet they have not been able to agree on one single intelligible and sound proposition. They are, even at the present day, divided into a multitude of schools that are incessantly disputing on the first elements of their doctrines. In fact, interior observation gives rise to almost as many divergent opinions as there are so-called observers.

The true scientists—the men devoted to the positive sciences—are still calling in vain on these psychologists to cite a single real discovery, great or small, due to this much-vaunted method. It does not follow that all their labors have been absolutely fruitless as regards the general progress of our knowledge, and we must remember the valuable service that they rendered in sustaining the activity of human intelligence at a time when it could not find a more substantial ailment. But their writings consist largely of that which an illustrious positive philosopher, M. Cuvier,¹¹ has well called “*metaphors mistaken for reasoning.*” We may safely affirm that any true notions they present have been obtained, not by their pretended method, but by observations on the progress of the human mind—observations to which the development of the sciences has from time to time given birth. And even these ideas, so scanty in number, although proclaimed with so much emphasis, and due only to the unfaithfulness of the psychologists to their pretended methods, are generally either greatly exaggerated or very incomplete, and they are very inferior to the remarks that scientists have already unostentatiously made upon the methods which they employ. It would be easy to cite some striking examples of this, if I did not fear that I should be prolonging the discussion of the point too much: take, for instance, the treatment of the theory of [algebraical] signs [by metaphysicians and geometers respectively].

The considerations relating to logical science which I have just indicated become still more evident when we deal with the art of logic.

¹¹ Georges L. C. F. D. Cuvier (1769–1832), French naturalist and founder of the science of comparative anatomy. An opponent of the evolutionary theories of Jean Baptiste Lamarck (1744–1829).

For when we want not only to know what the positive method consists in, but also to have such a clear and deep knowledge of it as to be able to use it effectively, we must consider it in action; we must study the various great applications of the method that the human mind has made and already verified. In a word, it is only by a philosophical examination of the sciences that we can attain the desired result. The method does not admit of being studied apart from the researches on which it is employed; or, at all events, it is only a lifeless study, incapable of fertilizing the mind that resorts to it. Looking at it in that abstract way, the only real information that you can give about it amounts to no more than a few general propositions, so vague that they can have no influence on mental habits. When we have thoroughly established as a logical thesis that all our knowledge must be founded upon observation, that we must proceed sometimes from facts to principles, at other times from principles to facts, and some other similar aphorisms, we still know the method far less clearly than he who, even without any philosophical purpose in view, has studied at all completely a single positive science. It is because they have failed to recognize this essential fact that our psychologists have been led to take their reveries for science, in the belief that they understood the positive method because they have read the precepts of Bacon or the discourse of Descartes.

I do not know if, in the future, it will become possible to construct by a priori reasoning a genuine course on method, wholly independent of the philosophical study of the sciences; but I am quite convinced that it cannot be done at present, for the great logical methods cannot yet be explained with sufficient precision apart from their applications. I venture to add, moreover, that, even if such an enterprise could be carried out eventually, which is conceivable, it would nevertheless be only through the study of regular applications of scientific methods that we could succeed in forming a good system of intellectual habits; this is, however, the essential object to be gained by studying method. There is no need to insist further just now on a subject that will recur frequently throughout this work and

in regard to which I shall present some new considerations in the next chapter.

The first great direct result of the positive philosophy is then the manifestation by experience of the laws that our intellectual functions follow in their operations and, consequently, a precise knowledge of the general rules that are suitable for our guidance in the investigation of truth. //

A second consequence, of no less importance and of much more urgent concern, which must immediately result from the establishment of the positive philosophy as defined in this chapter, is the general recasting of our educational system. //

Competent judges are already unanimous in recognizing the necessity of replacing our European education, which is still essentially theological, metaphysical, and literary, by a positive education in accordance with the spirit of our time and adapted to the needs of modern civilization. Various attempts have been made in increasing number during the last hundred years, and especially during recent years, to spread and augment, without ceasing, instruction of a positive kind. Such attempts, which the different European governments have always eagerly encouraged and often initiated, are a sufficient testimony that the spontaneous feeling of this necessity is everywhere growing. But, while supporting these useful enterprises as much as possible, we must not conceal the fact that in the present state of our ideas they are not at all capable of attaining their principal object—namely, the fundamental regeneration of general education. The exclusive speciality, the too rigid isolation, which still characterizes our way of conceiving and of cultivating the sciences, has necessarily a marked influence upon the mode of teaching them. An intelligent person who wishes at the present day to study the principal branches of natural philosophy, in order to acquire a general system of positive ideas, is obliged to study each separate science in the same way and with the same amount of detail as if he wished to become an astronomical or chemical specialist, etc. This renders such an education almost impossible and neces-

sarily very imperfect, even in the case of the most intelligent minds placed in the most favorable circumstances. Such a mode of proceeding would, therefore, be wholly chimerical as regards general education; and yet, an essential requirement of the latter is a complete body of positive conceptions on all the great classes of natural phenomena. It is such a general survey, on a more or less extended scale, which must henceforth constitute, even among the mass of the people, the permanent basis of all human combinations; it must, in short, constitute the mental framework of our descendants. In order that natural philosophy may be able to complete the already partially accomplished regeneration of our intellectual system, it is therefore indispensable that the different sciences of which it is composed—regarding them as the different branches of a single trunk—should first be reduced to what constitutes their essence—that is, to their principal methods and most important results. It is in this way only that the teaching of the sciences can become the basis of a new general and really rational education for our people. Of course, each individual, after receiving this general education, will have to supplement it by such special education as he may require, in which he will study one or other of the special sciences. But the essential consideration which I wish to point out here is that all these special studies, even if all of them were toilsomely compiled, would necessarily be insufficient really to renew our educational system, if they did not rest on the preliminary basis of this general education which is itself the direct result of the positive philosophy as defined in this discourse.

The special study of the general traits of the sciences is not only destined to reorganize education, but it will also contribute to the particular progress of the different positive sciences. This constitutes the third fundamental property that I have to point out.

The divisions that we establish between the sciences, although not arbitrary as some people suppose, are yet essentially artificial. In reality, the subject of all our researches is one; we

divide it only so that we may, by separating the difficulties, resolve them more easily. And so it not infrequently happens that these established divisions are a hindrance, and that questions arise which need to be treated by combining the points of view of several sciences. This cannot be done easily when scientists are so addicted to specialization. Hence, the problems are left unsolved for a much longer time than would otherwise be necessary. Such an inconvenience must make itself especially felt in the case of the more essential doctrines of each positive science. Very striking examples of this fact could be cited easily, and I shall carefully call attention to them as they occur in the course of this work.

I could cite a very memorable example of this from the past, in the case of the admirable conception of Descartes relating to analytical geometry. This fundamental discovery, which has changed the aspect of mathematical science and in which we should see the true germ of all the great subsequent progress, is it not simply the result of establishing a closer connection between two sciences that had hitherto been regarded from separate standpoints. But the case will be even more decisive if we consider some questions that are still under discussion.

I will take the case, in chemistry, of the important doctrine of definite proportions. It is certain that the memorable discussion which has been raised in our own time, relating to the fundamental principle of this theory, cannot yet be considered, in spite of appearances, as irrevocably terminated. For this is not, in my opinion, a simple question of chemistry. I venture to assert that, in order to settle the point definitively—that is, to determine whether it is a law of nature that atoms necessarily combine together in fixed proportions—it will be indispensable to unite the chemical with the physiological point of view. This is shown by the fact that, even in the opinion of the illustrious chemists who have most powerfully contributed to the formation of this doctrine, the utmost that can be said is that it is always verified in the composition of inorganic bodies; but it is no less constantly at fault in the case of organic compounds, to which up to the present it seems quite impossible to extend the doctrine. Now,

before erecting the theory into a truly fundamental principle, ought not this immense exception to be considered first? Does it not belong to the same general characteristic of all organic bodies, that in none of their phenomena can we make use of invariable numbers? However that may be, an entirely new order of considerations, belonging equally to chemistry and physiology, is evidently necessary in order to decide finally, in some way or other, this great question of natural philosophy.

I think it will be well to consider here a second example of the same kind, which since it relates to a subject of much more limited scope, shows even more conclusively the special importance of the positive philosophy in the solution of questions that need the combination of several sciences. This example, which I also take from chemistry, is the still controverted question as to whether, in the present state of our knowledge, nitrogen should be regarded as an element or a compound. The illustrious Berzelius¹² [differing from almost all living chemists] believes it to be a compound; and his reasons, of a purely chemical nature, successfully balance those of present-day chemists. But what I want particularly to point out is that Berzelius, as he admits himself—and a most instructive admission it is—was greatly influenced by the physiological observation that animals that feed on non-nitrogenous matter contain in their tissues just as much nitrogen as the carnivorous animals. It is therefore quite clear that, in order to decide whether nitrogen is or is not an element, we must necessarily call in the aid of physiology, and combine with chemical considerations, properly so called, a series of new researches on the relationships between the composition of living bodies and the nature of their food.

It would be superfluous now to go on multiplying examples of these complex problems, which can be solved only by the ultimate combination of several sciences that are at present cultivated in a wholly independent manner. Those which I have just

¹² Jöns Jakob Berzelius (1779–1848). Swedish chemist, discoverer of several new elements and notable contributor to atomic theory after John Dalton (1766–1844).

cited are sufficient to show in a general way the importance of the function that the positive philosophy will perform in perfecting each of the natural sciences, for it is directly destined to organize in a permanent manner combinations of this kind, which could not be formed suitably without its aid.

Social change
I must draw attention to a fourth and last fundamental property of that which I have called the positive philosophy, and which no doubt deserves our notice more than any other property, for it is today the most important one from a practical point of view. We may look upon the positive philosophy as constituting the only solid basis of the social reorganization that must terminate the crisis in which the most civilized nations have found themselves for so long. The last part of this course will be specially devoted to establish and develop this proposition. But the general sketch of my great subject which I have undertaken to give in this chapter would lack one of its most characteristic elements if I failed to call attention here to such an essential consideration.

It may be thought that I am making too ambitious a claim for the positive philosophy. But a few very simple reflections will suffice to justify it.

moral crisis, intellectual anarchy
There is no need to prove to readers of this work that the world is governed and overturned by ideas, or, in other words, that the whole social mechanism rests finally on opinions. They know, above all, that the great political and moral crisis of existing societies is due at bottom to intellectual anarchy. Our gravest evil consists, indeed, in this profound divergence that now exists among all minds, with regard to all the fundamental maxims whose fixity is the first condition of a true social order. As long as individual minds are not unanimously agreed upon a certain number of general ideas capable of forming a common social doctrine, we cannot disguise the fact that the nations will necessarily remain in an essentially revolutionary state, in spite of all the political palliatives that may be adopted. Such a condition of things really admits only of provisional institutions. It is equally

certain that, if this general agreement upon first principles can once be obtained, the appropriate institutions will necessarily follow, without giving rise to any grave shock; for the greater part of the disorder will have been already dissipated by the mere fact of the agreement. All those, therefore, who feel the importance of a truly normal state of things should direct their attention mainly to this point.

And now, from the lofty standpoint to which the various considerations indicated in this chapter have step by step raised us, it is easy both to characterize clearly the present state of society as regards its inner spirit, and to deduce therefrom the means by which that state can be changed essentially. Returning to the fundamental law enunciated at the commencement of this chapter, I think we may sum up exactly all the observations relating to the existing situation of society, by the simple statement that the actual confusion of men's minds is at bottom due to the simultaneous employment of three radically incompatible philosophies—the theological, the metaphysical, and the positive. It is quite clear that, if any one of these three philosophies really obtained a complete and universal preponderance, a fixed social order would result, whereas the existing evil consists above all in the absence of any true organization. It is the existence of these three opposite philosophies that absolutely prevents all agreement on any essential point. Now, if this opinion be correct, all that is necessary is to know which of the three philosophies can and must prevail by the nature of things; every sensible man should next endeavor to work for the triumph of that philosophy, whatever his particular opinions may have been before the question was analyzed. The question being once reduced to these simple terms, the issue cannot long remain doubtful, because it is evident for all kinds of reasons, some of the principal of which have been indicated in this chapter, that the positive philosophy is alone destined to prevail in the ordinary course of things. It alone has been making constant progress for many centuries, while its antagonists have been as constantly in a state of decay. Whether this is a good or a bad thing matters little; the general fact cannot be denied, and that is sufficient. We may deplore the

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fact, but we are unable to destroy it; nor, consequently, can we neglect it, on pain of giving ourselves up to illusory speculations. This general revolution of the human mind is at the present time almost entirely accomplished. Nothing more remains to be done, as I have already explained, than to complete the positive philosophy by including in it the study of social phenomena, and then to sum them up in a single body of homogeneous doctrine. When these two tasks have made sufficient progress, the final triumph of the positive philosophy will take place spontaneously, and will reestablish order in society. The marked preference which almost all minds, from the highest to the lowest, show at the present day for positive knowledge, as contrasted with vague and mystical conceptions, augers well for the reception that awaits this philosophy when it shall have acquired the only quality that it still lacks—a character of suitable generality.

To sum up the matter: the theological and metaphysical philosophies are now disputing with each other the task of reorganizing society, although the task is really too hard for their united efforts; it is between these schools only that any struggle still exists in this respect. The positive philosophy has, up to the present, intervened in the contest only in order to criticize both schools; and it has accomplished this task so well as to discredit them entirely. Let us put it in a condition to play an active part, without paying any further attention to debates that have become useless. We must complete the vast intellectual operation commenced by Bacon, Descartes, and Galileo, by furnishing the positive philosophy with the system of general ideas that is destined to prevail henceforth, and for an indefinite future, among the human race. The revolutionary crisis which harasses civilized peoples will then be at an end.

Such are the four principal advantages that will follow from the establishment of the positive philosophy. I have thought it well to mention them at once, because they supplement the general definition that I have tried to give of it.

Before concluding, I desire to caution the reader briefly against an erroneous anticipation which he might form as to the nature of the present work.

In saying that the aim of the positive philosophy was to sum

up, in a single body of homogeneous doctrine, the aggregate of acquired knowledge relating to the different orders of natural phenomena, I did not mean that we should proceed to the general study of these phenomena by looking upon them all as so many different effects of a single principle, as reducible to one sole law. Although I must treat this question specially in the next chapter, I think it necessary to say so much at once, in order to avoid unfounded objections that might otherwise be raised. I refer to those critics who might jump to the conclusion that this course is one of those attempts at universal explanation by a single law, which one sees made daily by men who are entire strangers to scientific methods and knowledge. Nothing of that kind is intended here; and the development of this course will furnish the best proof of it to all those whom the explanations contained in this chapter might have left in any doubt on the subject. //

It is my deep personal conviction that these attempts at the universal explanation of all phenomena by a single law are highly chimerical, even when they are made by the most competent minds. I believe that the resources of the human mind are too feeble, and the universe is too complicated, to admit of our ever attaining such scientific perfection; and I also think that a very exaggerated idea is generally formed of the advantages to be derived from it, even were it attainable. In any case, it seems to me evident that, considering the present state of our knowledge, we are yet a long way from the time when any such attempt might reasonably be expected to succeed. It seems to me that we could hope to arrive at it only by connecting all natural phenomena with the most general positive law with which we are acquainted—the law of gravitation—which already links all astronomical phenomena to some of the phenomena of terrestrial physics. Laplace¹³ has effectively brought forward a conception

¹³ Pierre Simon Laplace (1749–1827), French astronomer and mathematician, author of *Mécanique céleste* (1799–1825) and particularly noted for his conviction that all the phenomena of the universe can in principle be explained and predicted in terms of the laws of classical mechanics alone.

by which chemical phenomena would be regarded as purely simple molecular effects of Newtonian attraction, modified by the figure and mutual position of the atoms. This conception would probably always remain an open question, owing to the absence of any essential data respecting the intimate constitution of bodies; and it is almost certain that the difficulty of applying the idea would be so great that we should still be obliged to retain, as an artificial aid, the division which at present is regarded as natural between astronomy and chemistry. Accordingly, Laplace only presented this idea as a mere philosophical game which is incapable of really exercising any useful influence on the progress of chemical science. The case is really stronger, however, for even if we supposed this insurmountable difficulty overcome, we should still not have attained scientific unity, since it would be necessary next to connect the same law of gravitation with the whole of physiology; and this would certainly not be the least difficult part of the task. Yet, the hypothesis which we have just been discussing would be, on the whole, the most favorable to this much-desired unity.

I have no need to go further into details in order to convince the reader that the object of this course is by no means to present all natural phenomena as being at bottom identical, apart from the variety of circumstances. The positive philosophy would no doubt be more perfect if this were possible. But this condition is not at all necessary, either for its systematic formation or for the realization of the great and happy consequences which we have seen that it is destined to produce. The only indispensable unity for those purposes is that of method, which can and evidently must be, and is already largely established. As to the scientific product, it is not necessary that it should be unified; it is sufficient if it be homogeneous. It is, therefore, from the double standpoint of unity of method and homogeneity of scientific propositions that the different classes of positive theories will be considered in the present work. While trying to diminish as far as possible the number of general laws necessary for the positive explanation of natural phenomena—which is the real philosophic purpose of all science—we shall think it rash ever to hope, even in the most distant future, to reduce these laws rigorously to a single one.

I have attempted in this chapter to determine, as exactly as I could, the aim, the spirit, and the influence of the positive philosophy. I have, therefore, indicated the goal toward which my labors have always tended, and always will tend unceasingly, in this course or elsewhere. No one is more profoundly convinced than myself of the inadequacy of my intellectual powers, even if they were far superior to what they are, to undertake such a vast and noble work. But, although the task is too great for a single mind or a single lifetime, yet one man can state the problem clearly, and that is all I am ambitious of doing.

Having thus expounded the true aim of this course, by setting the point of view from which I shall consider the various principal branches of natural philosophy, I shall in the next chapter complete these general preliminaries by explaining the plan I have adopted—that is to say, by determining the encyclopedic order that should be established among the several classes of natural phenomena and, consequently, among the corresponding positive sciences.