THE

CLASSIFICATION

OF

THE SCIENCES:

TO WHICH ARE ADDED

REASONS FOR DISSENTING

FROM THE

PHILOSOPHY OF M. COMTE.

BY

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SECOND EDITION.

(WITH AN APPENDIX).

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PREFACE

TO THE SECOND EDITION.

THE first edition of this Essay is not yet out of print. But a proposal to translate it into French having been made by Professor Réthoré, I have decided to prepare a new edition free from the imperfections which criticism and further thought have disclosed, rather than allow these imperfections to be reproduced.

The occasion has almost tempted me into some amplification. Further arguments against the classification of M. Comte, and further arguments in support of the classification here set forth, have pleaded for utterance. But reconsideration has convinced me that it is both needless and useless to say more —needless because those who are not committed will think the case sufficiently strong as it stands, and useless because to those who are committed additional reasons will seem as inadequate as the original ones.

This last conclusion is thrust on me by seeing how little M. Littré, the leading expositor of M. Comte, is influenced by fundamental objections the force of which he admits. After quoting one of these, he

says, with a candour equally rare and admirable, that he has vainly searched M. Comte's works and his own mind for an answer. Nevertheless, he adds—"j'ai réussi, je crois, à écarter l'attaque de M. Herbert Spencer, et à sauver le fond par des sacrifices indispensables mais accessoires." The sacrifices are these. He abandons M. Comte's division of Inorganic Science into Celestial Physics and Terrestrial Physics—a division which, in M. Comte's scheme, takes precedence of all the rest; and he admits that neither logically nor historically does Astronomy come before Physics, as M. Comte alleges. After making these sacrifices, which most will think too lightly described as "sacrifices indispensables mais accessoires," M. Littré proceeds to rehabilitate the Comtean classification in a way which he considers satisfactory, but which I do not understand. In short, the proof of these incongruities affects his faith in the Positivist theory of the sciences, no more than the faith of a Christian is affected by proof that the Gospels contradict one another.

Here in England I have seen no attempt to meet the criticisms with which M. Littré thus deals. There has been no reply to the allegation, based on examples, that the several sciences do not develop in the order of their decreasing generality; nor to the allegation, based on M. Comte's own admissions, that within each science the progress is not, as he says it is, from the general to the special; nor to

the allegation that the seeming historical precedence of Astronomy over Physics in M. Comte's pages, is based on a verbal ambiguity—a mere sleight of words; nor to the allegation, abundantly illustrated, that a progression in an ordre the reverse of that asserted by M. Comte may be as well substantiated; nor to various minor allegations equally irreconcileable with his scheme. I have met with nothing more than iteration of the statement that the sciences *do* conform, logically and historically, to the order in which M. Comte places them; regardless of the assigned evidence that they *do not*.

Under these circumstances it is unnecessary for me to say more; and I think I am warranted in continuing to hold that the Comtean classification of the sciences is demonstrably untenable.

While, however, I have not entered further into the controversy, as I thought of doing, I have added at the close an already-published discussion, no longer easily accessible, which indirectly enforces the general argument.

LONDON, 23RD APRIL, 1869.

THE

CLASSIFICATION OF THE SCIENCES.

In an essay on "The Genesis of Science," originally published in 1854, I endeavoured to show that the Sciences cannot be rationally arranged in serial order. Proof was given that neither the succession in which the Sciences are placed by M. Comte (to a criticism of whose scheme the essay was in part devoted), nor any other succession in which the Sciences can be placed, represents either their logical dependence or their historical dependence. To the question—How may their relations be rightly expressed? I did not then attempt any answer. This question I propose now to consider.

A true classification includes in each class, those objects which have more characteristics in common with one another, than any of them have in common with any objects excluded from the class. Further, the characteristics possessed in common by the colligated objects, and not possessed by other objects, are more radical than any characteristics possessed in common with other objects—involve more numerous

dependent characteristics. These are two sides of the same definition. For things possessing the greatest number of attributes in common, are things that possess in common those essential attributes on which the rest depend; and, conversely, the possession in common of the essential attributes, implies the possession in common of the greatest number of attributes. Hence, either test may be used as convenience dictates.

If, then, the Sciences admit of classification at all, it must be by grouping together the like and separating the unlike, as thus defined. Let us proceed to do this.

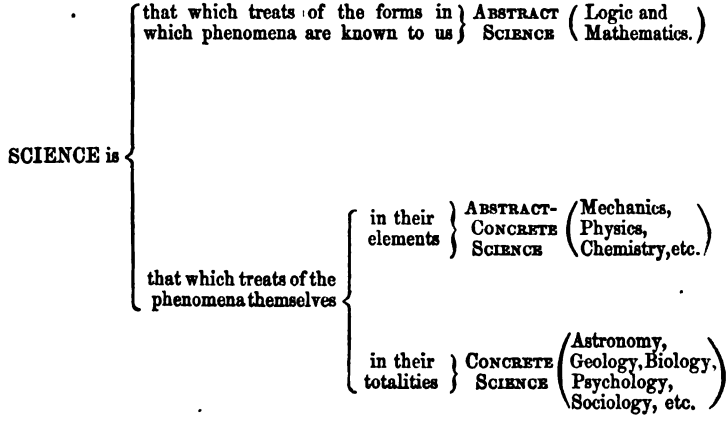
The broadest natural division among the Sciences, is the division between those which deal with the abstract relations under which phenomena are presented to us, and those which deal with the phenomena themselves. Relations of whatever orders, are nearer akin to one another than they are to any objects. Objects of whatever orders, are nearer akin to one another than they are to any relations. Whether, as some hold, Space and Time are forms of Thought; or whether, as I hold myself, they are forms of Things, that have become forms of Thought through organized and inherited experience of Things; it is equally true that Space and Time are contrasted absolutely with the existences disclosed to us in Space and Time and that the Sciences which deal exclusively with Space and Time, are separated by the profoundest of all distinctions from the Sciences which deal with th

existences that Space and Time contain. Space is the abstract of all relations of co-existence. Time is the abstract of all relations of sequence. And dealing as they do entirely with relations of co-existence and sequence, in their general or special forms, Logic and Mathematics form a class of the Sciences more widely unlike the rest, than any of the rest can be from one another.

The Sciences which deal with existences themselves, instead of the blank forms in which existences are presented to us, admit of a sub-division less profound than the division above made, but more profound than any of the divisions among the Sciences individually considered. They fall into two classes, having quite different aspects, aims, and methods. Every phenomenon is more or less composite—is a manifestation of force under several distinct modes. Hence result two objects of inquiry. We may study the component modes of force separately; or we may study them in their relations, as co-operative factors in this composite phenomenon. On the one hand, neglecting all the incidents of particular cases, we may aim to educe the laws of each mode of force, when it is uninterfered with. On the other hand, the incidents of the particular case being given, we may seek to interpret the entire phenomenon, as a product of the several forces simultaneously in action. The truths reached through the first kind of inquiry, though concrete inasmuch as they have actual existences for their subject-matters,

are abstract inasmuch as they refer to the modes of existence apart from one another; while the truths reached by the second kind of inquiry are properly concrete, inasmuch as they formulate the facts in their combined order, as they occur in Nature.

The Sciences, then, in their main divisions, stand thus:—



It is needful to define the words *abstract* and *concrete* as thus used; since they are sometimes used with other meanings. M. Comte divides Science into abstract and concrete; but the divisions which he distinguishes by these names are quite unlike those above made. Instead of regarding some Sciences as wholly abstract, and others as wholly concrete, he regards each Science as having an abstract part, and a concrete part. There is, according to him, an abstract mathematics and a concrete mathematics—an

abstract biology and concrete biology. He says:—"Il faut distinguer, par rapport à tous les ordres de phénomènes, deux genres de sciences naturelles: les unes abstraites, générales, ont pour objet la découverte des lois qui régissent les diverses classes de phénomènes, en considérant tous les cas qu'on peut concevior; les autres concrètes, particulières, descriptives, et qu'on désigne quelquefois sous le nom de sciences naturelles proprement dites, consistent dans l'application de ces lois a l'histoire effective de différens êtres existans." And to illustrate the distinction, he names general physiology as abstract, and zoology and botany as concrete. Here it is manifest that the words *abstract* and *general* are used as synonymous. They have, however, different meanings; and confusion results from not distinguishing their meanings. Abstractness means *detachment from* the incidents of particular cases. Generality means *manifestation in* numerous cases. On the one hand, the essential nature of some phenomenon is considered, apart from disguising phenomena. On the other hand, the frequency of the phenomenon, with or without disguising phenomena, is the thing considered. Among the ideal relations of numbers the two coincide; but excluding these, an abstract truth is not realizable to perception in any case of which it is asserted, whereas a general truth is realizable to perception in every case of which it is asserted. Some illustrations will make the distinction clear. Thus it is an abstract truth that the angle contained

in a semi-circle is a right angle—abstract in the sense that though it does not hold in actually-constructed semi-circles and angles, which are always inexact, it holds in the ideal semi-circles and angles abstracted from real ones; but this is not a general truth, either in the sense that it is commonly manifested in Nature, or in the sense that it is a space-relation that comprehends many minor space-relations: it is a quite special space-relation. Again, that the momentum of a body causes it to move in a straight line at a uniform velocity, is an abstract-concrete truth—a truth abstracted from certain experiences of concrete phenomena; but it is by no means a general truth: so little generality has it, that no one fact in Nature displays it. Conversely, surrounding things supply us with hosts of general truths that are not in the least abstract. It is a general truth that the planets go round the Sun from West to East—a truth which holds good in something like a hundred cases (including the cases of the planetoids); but this truth is not at all abstract, since it is perfectly realized as a concrete fact in every one of these cases. Every vertebrate animal whatever, has a double nervous system; all birds and all mammals are warm-blooded—these are general truths, but they are concrete truths: that is to say, every vertebrate animal individually presents an entire and unqualified manifestation of this duality of the nervous system; every living bird exemplifies absolutely or completely

the warm-bloodedness of birds. What we here call, and rightly call, a general truth, is simply a proposition which *sums up* a number of our actual experiences; and not the expression of a truth *drawn from* our actual experiences, but never presented to us in any of them. In other words, a general truth colligates a number of particular truths; while an abstract truth colligates no particular truths, but formulates a truth which certain phenomena all involve, though it is actually seen in none of them.

Limiting the words to their proper meanings as thus defined, it becomes manifest that the three classes of Sciences above separated, are not distinguishable at all by differences in their degrees of generality. They are all equally general; or rather they are all, considered as groups, universal. Every object whatever presents at once the subject-matter for each of them. In the smallest particle of substance we have simultaneously illustrated the abstract truths of relation in Time and Space; the abstract-concrete truths in conformity with which the particle manifests its several modes of force; and the concrete truths which are the laws of the joint manifestation of these modes of force. Thus these three classes of Sciences severally formulate different, but co-extensive, classes of facts. Within each group there are truths of greater and less generality: there are general abstract truths, and special abstract truths; general abstract-concrete truths, and special abstract-concrete truths;

general concrete truths, and special concrete truths. But while within each class there are groups and sub-groups and sub-sub-groups which differ in their degrees of generality, the classes themselves differ only in their degrees of abstractness.*

* Some propositions laid down by M. Littré, in his lately-published book—*Auguste Comte et la Philosophie Positive*, may fitly be dealt with here. In the candid and courteous reply he makes to my strictures on the Comtean classification in "The Genesis of Science," he endeavours to clear up some of the inconsistencies I pointed out; and he does this by drawing a distinction between objective generality and subjective generality. He says—"qu'il existe deux ordres de généralité, l'une objective et dans les choses, l'autre subjective, abstraite et dans l'esprit." This sentence, in which M. Littré makes subjective generality synonymous with abstractness, led me at first to conclude that he had in view the same distinction as that which I have above explained between generality and abstractness. On re-reading the paragraph, however, I found this was not the case. In a previous sentence he says—"La biologie a passé de la considération des organes à celles des tissus, plus généraux que les organes, et de la considération des tissus à celle des éléments anatomiques, plus généraux que les tissus. Mais cette généralité croissante est subjective non objective, abstraite non concrète." Here it is manifest that abstract and concrete, are used in senses analogous to those in which they are used by M. Comte; who, as we have seen, regards general physiology as abstract and zoology and botany as concrete. And it is further manifest that the word abstract, as thus used, is not used in its proper sense. For, as above shown, no such facts as those of anatomical structure can be abstract facts; but can only be more or less general facts. Nor do I understand M Littré's point of view when he regards these more general facts of anatomical structure, as *subjectively* general and not *objectively* general. The structural phenomena presented by any tissue, such as mucous membrane, are more general than the phenomena presented by any of the organs which mucous membrane goes to form, simply in the sense that the phenomena peculiar to the membrane are repeated in a greater number of instances than the phenomena peculiar to any organ into the composition of which the membrane enters. And, similarly, such facts as have been established respecting the anatomical elements of tissues, are more general than the facts established respecting any particular tissue, in the sense that they are facts which organic bodies exhibit in a greater number of cases—they are *objectively* more general; and they can be called *subjectively* more general only in the sense that the conception corresponds with the phenomena.

Let me endeavour to clear up this point:—There is, as M. Littré truly says, a decreasing generality that is objective. If we omit the phenomena of Dissolution, which are changes from the special to the general, all changes which matter undergoes are from the general to the special—are changes involving a decreasing

Passing to the sub-divisions of these classes, we find that the first class is separable into two parts—the one containing universal truths, the other non-universal truths. Dealing wholly with relations apart from related things, Abstract Science considers first, that which is common to all relations whatever; and second, that which is common to each order of relations. Besides the indefinite and variable connexions which exist among phenomena, as occurring together in Space and Time, we find that there are also definite

generality in the united groups of attributes. This is the progress of *things*. The progress of *thought*, is not only in the same direction, but also in the opposite direction. The investigation of Nature discloses an increasing number of specialities; but it simultaneously discloses more and more the generalities within which these specialities fall. Take a case. Zoology, while it goes on multiplying the number of its species, and getting a more complete knowledge of each species (decreasing generality); also goes on discovering the common characters by which species are united into larger groups (increasing generality). Both these are subjective processes; and in this case, both orders of truths reached are concrete—formulate the phenomena as actually manifested.

M. Littré, recognizing the necessity for some modification of the hierarchy of the Sciences, as enunciated by M. Comte, still regards it as substantially true; and for proof of its validity, he appeals mainly to the essential *constitutions* of the Sciences. It is unnecessary for me here to meet, in detail, the arguments by which he supports the proposition, that the essential constitutions of the Sciences, justify the order in which M. Comte places them. It will suffice to refer to the foregoing pages, and to the pages which are to follow, as containing the definitions of those fundamental characteristics which demand the grouping of the Sciences in the way pointed out. As already shown, and as will be shown still more clearly by and bye, the radical differences of constitution among the Sciences, necessitate the colligation of them into the three classes—Abstract, Abstract-Concrete, and Concrete. How irreconcilable is M. Comte's classification with these groups, will be at once apparent on inspection. It stands thus:—

Mathematics (including rational Mechanics), ...	partly Abstract, partly Abstract-Concrete.
Astronomy	Concrete.
Physics.....	Abstract-Concrete.
Chemistry	Abstract-Concrete.
Biology.....	Concrete.
Sociology	Concrete.

and invariable connexions—that between each kind of phenomenon and certain other kinds of phenomena, there exist uniform relations. This is a universal abstract truth—that there is an unchanging order among things in Space and Time. We come next to the several kinds of unchanging order, which, taken together, form the subjects of the second division of Abstract Science. Of this second division, the most general sub-division is that which deals with the natures of the connexions in Space and Time, irrespective of the terms connected. The conditions under which we may predicate a relation of coincidence or proximity in Space and Time (or of non-coincidence or non-proximity) form the subject-matter of Logic. Here the natures and amounts of the terms between which the relations are asserted (or denied) are of no moment: the propositions of Logic are independent of any qualitative or quantitative specification of the related things. The other sub-division has for its subject-matter, the relations between terms which are specified quantitatively but not qualitatively. The amounts of the related terms, irrespective of their natures, are here dealt with; and Mathematics is a statement of the laws of quantity considered apart from reality. Quantity considered apart from reality, is occupancy of Space or Time; and occupancy of Space or Time is measured by the number of coexistent or sequent positions occupied. That is to say, quantities can be

compared and the relations between them established, only by some direct or indirect enumeration of their component units; and the ultimate units into which all others are decomposable, are such occupied positions in Space as can, by making impressions on consciousness, produce occupied positions in Time. Among units that are unspecified in their natures (extensive, protensive, or intensive), but are ideally endowed with existence considered apart from attributes, the quantitative relations that arise, are those most general relations expressed by numbers. Such relations fall into either of two orders, according as the units are considered simply as capable of filling separate places in consciousness, or according as they are considered as filling places that are not only separate, but equal. In the one case, we have that indefinite calculus by which numbers of abstract existences, but not sums of abstract existence, are predicable. In the other case, we have that definite calculus by which both numbers of abstract existences and sums of abstract existence are predicable. Next comes that division of Mathematics which deals with the quantitative relations of magnitudes (or aggregates of units) considered as coexistent, or as occupying Space—the division called Geometry. And then we arrive at relations, the terms of which include both quantities of Time and quantities of Space—those in which times are estimated by the units of space traversed at a uniform velocity, and those in which equal

units of time being given, the spaces traversed with uniform or variable velocities are estimated. These Abstract Sciences, which are concerned exclusively with relations and with the relations of relations, may be grouped as shown in Table I.

Passing from the Sciences that treat of the ideal or unoccupied forms of relations, and turning to the Sciences that treat of real relations, or the relations among realities, we come first to those Sciences which deal with realities, not as they are habitually manifested to us, but with realities as manifested in their different modes, when these are artificially separated from one another. In the same way that the Abstract Sciences are ideal, relatively to the Abstract-Concrete and Concrete Sciences; so the Abstract-Concrete Sciences are ideal, relatively to the Concrete Sciences. Just as Logic and Mathematics have for their object to generalize the laws of relation, qualitative and quantitative, apart from related things; so, Mechanics, Physics, Chemistry, etc., have for their object to generalize the laws of relation which different modes of Matter and Motion conform to, when severally disentangled from those actual phenomena in which they are mutually modified. Just as the geometrician formulates the properties of lines and surfaces, independently of the irregularities and thicknesses of lines and surfaces as they really exist; so, the physicist and the chemist formulate the mani-

TABLE I.

ABSTRACT SCIENCE.

- **Universal law of relation**—an expression of the truth that uniformities of connexion obtain among modes of Being, irrespective of any specification of the natures of the uniformities of connexion.
- **Laws of relations**
  - that are qualitative; or that are specified in their natures as relations of coincidence or proximity in Time and Space, but not necessarily in their terms: the natures and amount of which are indifferent. (LOGIC.)*
  - that are quantitative (MATHEMATICS)
    - negatively: the terms of the relations being definitely-related sets of positions in space; and the facts predicated being the absences of certain quantities. (*Geometry of Position.***)
    - positively: the terms being magnitudes composed of
      - units that are equal only as having independent existences. (*Indefinite Calculus.*†)
      - equal units
        - the equality of which is not defined as extensive, protensive, or intensive (*Definite Calculus*)
          - when their numbers are completely specified. (*Arithmetic.*)
          - when their numbers are specified only
            - in their relations. (*Algebra.*)
            - in the relations of their relations. (*Calculus of Operations.*)
        - the equality of which is that of extension
          - considered in their relations of coexistence. (*Geometry.*)
          - considered as traversed in Time
            - that is wholly indefinite. (*Kinematics.*)
            - that is divided into equal units. (*Geometry of Motion.*‡)

* This definition includes the laws of relations called necessary, but not those of relations called contingent. These last, in which the probability of an inferred connexion varies with the number of times such connexion has occurred in experience, are rightly dealt with mathematically.

** Here, by way of explanation of the term negatively-quantitative, it will suffice to instance the proposition that certain three lines will meet in a point, as a negatively-quantitative proposition; since it asserts the absence of any quantity of space between their intersections. Similarly, the assertion that certain three points will always fall in a straight line, is negatively-quantitative; since the conception of a straight line implies the negation of any lateral quantity, or deviation.

† Lest the meaning of this division should not be understood, it may be well to name, in illustration, the estimates of the statistician. Calculations respecting population. crime, disease, etc., have results which are correct only numerically, and not in respect of the totalities of being or action represented by the numbers.

‡ Perhaps it will be asked—How can there be a Geometry of Motion into which the conception of Force does not enter? The reply is, that the time-relations and space-relations of Motion may be considered apart from those of Force, in the same way that the space-relations of Matter may be considered apart from Matter.

festations of each mode of force, independently of the disturbances in its manifestations which other modes of force cause in every actual case. In works on Mechanics, the laws of motion are expressed without reference to friction and resistance of the medium. Not what motion ever really is, but what it would be if retarding forces were absent, is asserted. If any retarding force is taken into account, then the effect of this retarding force is alone contemplated: neglecting the other retarding forces. Consider, again, the generalizations of the physicist respecting molecular motion. The law that light varies inversely as the square of the distance, is absolutely true only when the radiation goes on from a point without dimensions, which it never does; and it also assumes that the rays are perfectly straight, which they cannot be unless the medium differs from all actual media in being perfectly homogeneous. If the disturbing effects of changes of media are investigated, the formulæ expressing the refractions take for granted that the new media entered are homogeneous; which they never really are. Even when a compound disturbance is allowed for, as when the refraction undergone by light in traversing a medium of increasing density, like the atmosphere, is calculated, the calculation still supposes conditions that are unnaturally simple—it supposes that the atmosphere is not pervaded by heterogeneous currents, which it always is. Similarly with the inquiries of the

chemist. He does not take his substances as Nature supplies them. Before he proceeds to specify their respective properties, he purifies them—separates from each all trace of every other. Before ascertaining the specific gravity of a gas, he has to free this gas from the vapour of water, usually mixed with it. Before describing the properties of a salt, he guards against any error that may arise from the presence of an uncombined portion of the acid or base. And when he alleges of any element that it has a certain atomic weight, and unites with such and such equivalents of other elements, he does not mean that the results thus expressed are exactly the results of any one experiment; but that they are the results which, after averaging many trials, he concludes would be realized if absolute purity could be obtained, and if the experiments could be conducted without loss. His problem is to ascertain the laws of combination of molecules, not as they are actually displayed, but as they would be displayed in the absence of those minute interferences which cannot be altogether avoided. Thus all these Abstract-Concrete Sciences have for their object, *analytical interpretation.* In every case it is the aim to decompose the phenomenon, and formulate its components apart from one another; or some two or three apart from the rest. Wherever, throughout these Sciences, synthesis is employed, it is for the verification of analysis.*

* I am indebted to Prof. Frankland for reminding me of an objection that may be

The truths elaborated are severally asserted, not as truths exhibited by this or that particular object; but as truths universally holding of Matter and Motion in their more general or more special forms, considered apart from particular objects, and particular places in space.

The sub-divisions of this group of Sciences, may be drawn on the same principle as that on which the sub-divisions of the preceding group were drawn. Phenomena, considered as more or less involved manifestations of force, yield on analysis, certain laws of manifestation that are universal, and other laws of manifestation, which, being dependent on conditions, are not universal. Hence the Abstract-Concrete Sciences are primarily divisible into—the laws of force considered apart from its separate modes, and laws of force considered under each of its separate modes. And this second division of the Abstract-Concrete group, is sub-divisible after a manner essentially analogous. It is needless to occupy space by

made to this statement. The production of new compounds by synthesis, has of late become an important branch of chemistry. According to certain known laws of composition, complex substances, which never before existed, are formed, and fulfil anticipations both as to their general properties and as to the proportions of their constituents—as proved by analysis. Here it may be said with truth, that analysis is used to verify synthesis. Nevertheless, the exception to the above statement is apparent only—not real. In so far as the production of new compounds is carried on merely for the obtainment of such new compounds, it is not Science but Art—the application of pre-established knowledge to the achievement of ends. The proceeding is a part of Science, only in so far as it is a means to the better interpretation of the order of Nature. And how does it aid the interpretation? It does it only by verifying the pre-established conclusions respecting the laws of molecular combination; or by serving further to explain them. That is to say, these syntheses, considered on their scientific side, have simply the purpose of *forwarding the analysis of the laws of chemical combination.*

defining these several orders and genera of Sciences. Table II. will sufficiently explain their relations.

We come now to the third great group. We have done with the Sciences which are concerned only with the blank forms of relations under which Being is manifested to us. We have left behind the Sciences which, dealing with Being under its universal mode, and its several non-universal modes regarded as independent, treats the terms of its relations as simple and homogeneous, which they never are in Nature. There remain the Sciences which, taking these modes of Being as they are connected with one another, have for the terms of their relations, those heterogeneous combinations of forces that constitute actual phenomena. The subject-matter of these Concrete-Sciences is the real, as contrasted with the wholly or partially ideal. It is their aim, not to separate and generalize apart the components of all phenomena; but to explain each phenomenon as a product of these components. Their relations are not, like those of the simplest Abstract-Concrete Sciences, relations between one antecedent and one consequent; nor are they, like those of the more involved Abstract-Concrete Sciences, relations between some few antecedents cut off in imagination from all others, and some few consequents similarly cut off; but they are relations each of which has for its terms a complete plexus of antecedents and a complete plexus of consequents. This is manifest in the

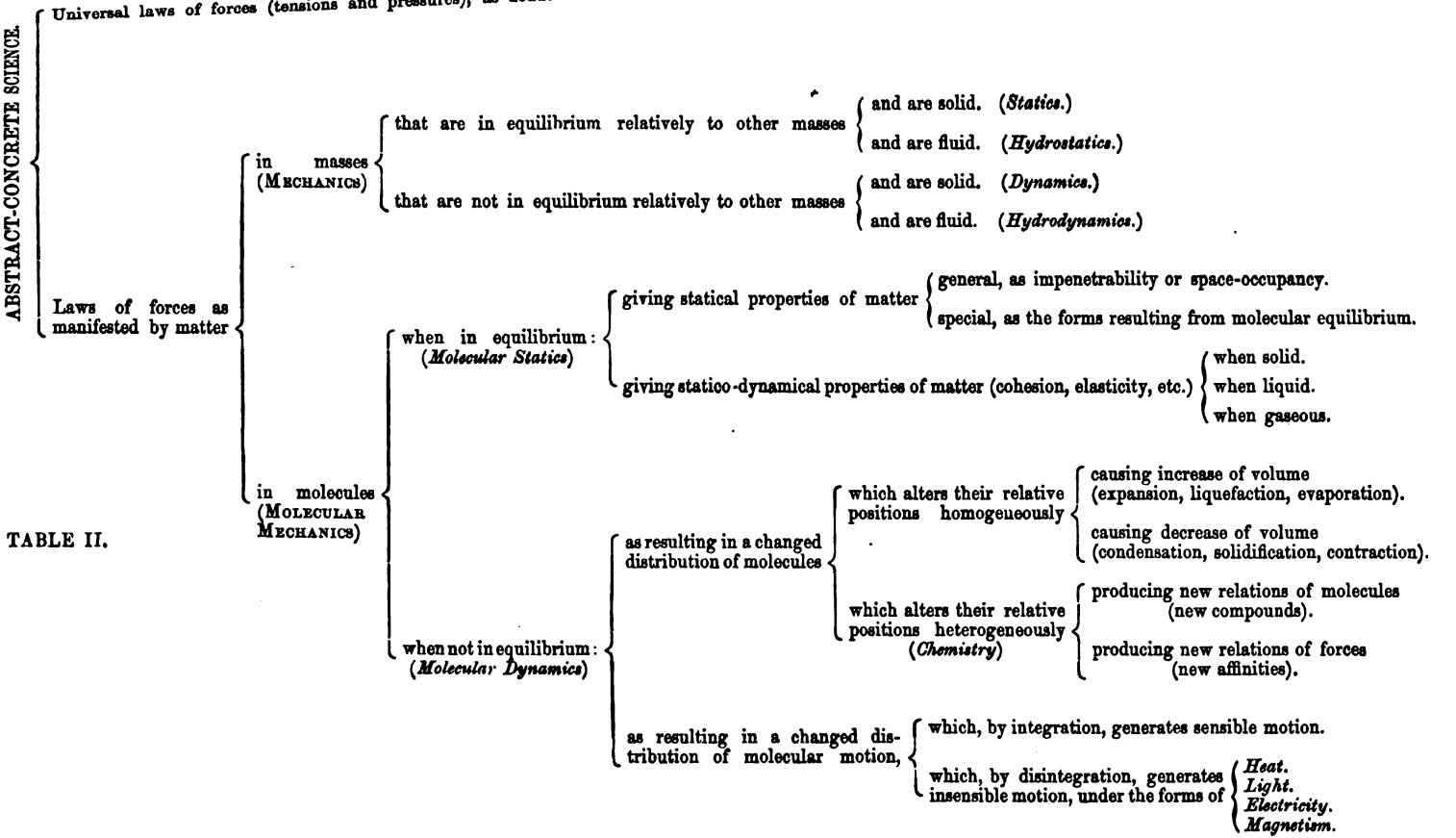


TABLE II.

least involved Concrete Sciences. The astronomer seeks to explain the Solar System. He does not stop short after generalizing the laws of planetary movement, such as planetary movement would be did only a single planet exist; but he solves this abstract-concrete problem, as a step towards solving the concrete problem of the planetary movements as affecting one another. In astronomical language, "the theory of the Moon" means an interpretation of the Moon's motions, not as determined simply by centripetal and centrifugal forces, but as perpetually modified by gravitation towards the Earth's equatorial protuberance, towards the Sun, and even towards Venus—forces daily varying in their amounts and combinations. Nor does the astronomer leave off when he has calculated what will be the position of a given body at a given time, allowing for all perturbing influences; but he goes on to consider the effects produced by reactions on the perturbing masses. And he further goes on to consider how these mutual perturbations of the planets cause, during a long period, increasing deviations from a mean state; and then how compensating perturbations cause continuous decrease in the deviations. That is, the goal towards which he ever strives, is a complete explanation of these complex planetary motions in their totality. Similarly with the geologist. He does not take for his problem only those irregularities of the Earth's crust that are worked by denudation; or only those which igneous

action causes. He does not seek simply to understand how sedimentary strata were formed; or how faults were produced; or how moraines originated; or how the beds of Alpine lakes were scooped out. But taking into account all agencies co-operating in endless and ever-varying combinations, he aims to interpret the entire structure of the Earth's crust. If he studies separately the actions of rain, rivers, glaciers, icebergs, tides, waves, volcanoes, earthquakes, etc.; he does so that he may be better able to comprehend their joint actions as factors in geological phenomena: the object of his science being to generalize these phenomena in all their involved connections, as parts of one whole. In like manner Biology is the elaboration of a complete theory of Life, in each and all of its involved manifestations. If different aspects of its phenomena are investigated apart—if one observer busies himself in classing organisms, another in dissecting them, another in ascertaining their chemical compositions, another in studying functions, another in tracing laws of modification; they are all, consciously or unconsciously, helping to work out a solution of vital phenomena in their entirety, both as displayed by individual organisms and by organisms at large. Thus, in these Concrete Sciences, the object is the converse of that which the Abstract-Concrete Sciences propose to themselves. In the one case we have analytical *interpretation;* while in the other case we have synthetical *interpretation.* Instead of synthesis

being used merely to verify analysis; analysis is here used only to aid synthesis. Not to formulate the factors of phenomena is now the object; but to formulate the phenomena resulting from these factors, under the various conditions which the Universe presents.

This third class of Sciences, like the other classes, is divisible into the universal and the non-universal. As there are truths which hold of all phenomena in their elements; so there are truths which hold of all phenomena in their totalities. As force has certain ultimate laws common to its separate modes of manifestation, so in those combinations of its modes which constitute actual phenomena, we find certain ultimate laws that are conformed to in every case. These are the laws of the re-distribution of force. Since we can become conscious of a phenomenon only by some change wrought in us, every phenomenon necessarily implies re-distribution of force—change in the arrangements of matter and motion. Alike in molecular movements and the movements of masses, one great uniformity may be traced. A decreasing quantity of motion, sensible or insensible, always has for its concomitant an increasing aggregation of matter; and, conversely, an increasing quantity of motion, sensible or insensible, has for its concomitant a decreasing aggregation of matter. Give to the molecules of any mass, more of that insensible motion which we call heat, and the parts of the mass become somewhat less closely aggregated. Add a further quantity of insensible motion,

and the mass so far disintegrates as to become liquid. Add still more insensible motion, and the mass disintegrates so completely as to become gas; which occupies a greater space with every extra quantity of insensible motion given to it. On the other hand, every loss of insensible motion by a mass, gaseous, liquid, or solid, is accompanied by a progressing integration of the mass. Similarly with sensible motions, be the bodies moved large or small. Augment the velocities of the planets, and their orbits will enlarge—the Solar System would occupy a wider space. Diminish their velocities, and their orbits will lessen—the Solar System will contract, or become more integrated. And in like manner we see that every sensible motion on the Earth's surface involves a partial disintegration of the moving body from the Earth; while the loss of its motion is accompanied by the body's re-integration with the Earth. In all phenomena we have either an integration of matter and concomitant dissipation of motion; or an absorption of motion and concomitant disintegration of matter. And where, as in living bodies, these processes are going on simultaneously, there is an integration of matter proportioned to the dissipation of motion, and an absorption of motion proportioned to the disintegration of matter. Such, then, are the universal laws of that re-distribution of matter and motion everywhere going on—a re-distribution which results in Evolution so long as

the aggregation of matter and dispersion of motion predominate; but which results in Dissolution where there is a predominant aggregation of motion and dispersion of matter. Hence we have a division of Concrete Science which bears towards the other Concrete Sciences, a relation like that which Universal Law of Relation bears to Mathematics, and like that which Universal Mechanics (composition and resolution of forces) bears to Physics. We have a division of Concrete Science which generalizes those concomitants of this re-distribution that hold good among all orders of concrete objects—a division which explains why, along with a predominating integration of matter and dissipation of motion, there goes a change from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity; and why a reverse re-distribution of matter and motion, is accompanied by a reverse structural change. Passing from this universal Concrete Science, to the non-universal Concrete Sciences; we find that these are primarily divisible into the science which deals with the re-distributions of matter and motion among the masses in space, consequent on their mutual actions as wholes; and the science which deals with the re-distributions of matter and motion consequent on the mutual actions of the molecules in each mass. And of these equally general Sciences, this last is re-divisible into the Science which is limited to the concomitants of re-distribution among the molecules of each mass when regarded as inde-

pendent, and the Science which takes into account the molecular motion received by radiation from other masses. But these sub-divisions, and their sub-sub-divisions, will be best seen in the annexed Table III.

That these great groups of Sciences and their respective sub-groups, fulfil the definition of a true classification given at the outset, is, I think, tolerably manifest. The subjects of inquiry included in each primary division, have essential attributes in common with one another, which they have not in common with any of the subjects contained in the other primary divisions; and they have, by consequence, a greater number of common attributes in which they severally agree with the colligated subjects, and disagree with the subjects otherwise colligated. Between Sciences which deal with relations apart from realities, and Sciences which deal with realities, the distinction is the widest possible; since Being, in some or all of its attributes, is common to all Sciences of the second class, and excluded from all Sciences of the first class. The distinction between the empty forms of things and the things themselves, is a distinction which cannot be exceeded in degree. And when we divide the Sciences which treat of realities, into those which deal with their separate components and those which deal with their components as united, we make a profounder distinction than can exist between the Sciences which deal with one or other order

TABLE III.

- **CONCRETE SCIENCE.**
  - Universal laws of the continuous re-distribution of Matter and Motion; which results in Evolution where there is a predominant integration of Matter and dissipation of Motion, and which results in Dissolution where there is a predominant absorption of Motion and disintegration of Matter.
  - Laws of the redistributions of Matter and Motion actually going on
    - among the celestial bodies in their relations to one another as masses: comprehending (ASTRONOMY)
      - the dynamics of our stellar universe. (*Sidereal Astronomy.*)
      - the dynamics of our solar system. (*Planetary Astronomy.*)
    - among the molecules of any celestial mass; as caused by
      - the actions of these molecules on one another (ASTROGENY)
        - resulting in the formation of compound molecules. (*Solar Mineralogy.*)
        - resulting in molecular motions and genesis of radiant forces.*
        - resulting in movements of gases and liquids. (*Solar Meteorology.*†)
      - the actions of these molecules on one another, joined with the actions on them of forces radiated by the molecules of other masses: (GEOGENY)
        - as exhibited in the planets generally.
        - as exhibited in the Earth
          - causing composition and decomposition of inorganic matters. (*Mineralogy.*)
          - causing re-distributions of gases and liquids. (*Meteorology.*)
          - causing re-distributions of solids. (*Geology.*)
          - causing organic phenomena; which are (*Biology*)
            - those of structure (*Morphology*)
              - general.
              - special.
            - those of function
              - in their internal relations (*Physiology*)
                - general.
                - special.
              - in their external relations (*Psychology*)
                - general
                - special
                  - separate.
                  - combined.

(*Sociology.*‡)

* This must not be supposed to mean chemically-produced forces. The molecular motion here referred to as dissipated in radiations, is the equivalent of that sensible motion lost during the integration of the mass of molecules, consequent on their mutual gravitation.

† Embracing the interpretation of such phenomena as the solar spots, the faculæ and the coronal flames.

‡ Want of space prevents anything beyond the briefest indication of these subdivisions.

of the components, or than can exist between the Sciences which deal with one or other order of the things composed. The three groups of Sciences may be briefly defined as—laws of the *forms;* laws of the *factors;* laws of the *products.* And when thus defined, it becomes manifest that the groups are so radically unlike in their natures, that there can be no transitions between them; and that any Science belonging to one of the groups must be quite incongruous with the Sciences belonging to either of the other groups, if transferred. How fundamental are the differences between them, will be further seen on considering their functions. The first, or abstract group, is *instrumental* with respect to both the others; and the second, or abstract-concrete group, is *instrumental* with respect to the third or concrete group. An endeavour to invert these functions will at once show how essential is the difference of character. The second and third groups supply subject-matter to the first, and the third supplies subject-matter to the second; but none of the truths which constitute the third group are of any use as solvents of the problems presented by the second group; and none of the truths which the second group formulates can act as solvents of problems contained in the first group. Concerning the subdivisions of these great groups, little remains to be added. That each of the groups, being co-extensive with all phenomena, contains truths that are universal

and others that are not universal, and that these must be classed apart, is obvious. And that the sub-divisions of the non-universal truths, are to be made in something like the manner shown in the tables, is proved by the fact that when the descriptive words are read from the root to the extremity of any branch, they form a definition of the Science constituting that branch. That the minor divisions might be otherwise arranged, and that better definitions of them might be given, is highly probable. They are here set down merely for the purpose of showing how this method of classification works out.

I will only further remark, that the relations of the Sciences as thus represented, are still but imperfectly represented: their relations cannot be truly shown on a plane, but only in space of three dimensions. The three groups cannot rightly be put in linear order as they have here been. Since the first stands related to the third, not only indirectly through the second, but also directly—it is directly instrumental with respect to the third, and the third supplies it directly with subject-matter. Their relations can thus only be truly shown by a divergence from a common root on different sides, in such a way that each stands in juxta-position to the other two. And only by the like mode of arrangement, can the relations among the sub-divisions of each group be correctly represented.

REASONS FOR DISSENTING

FROM THE

PHILOSOPHY OF M. COMTE.

WHILE the preceding pages were passing through the press, there appeared in the *Revue des Deux Mondes* for February 15th, an article on a late work of mine—*First Principles*. To M. Auguste Laugel, the writer of this article, I am much indebted for the careful exposition he has made of some of the leading views set forth in that work; and for the catholic and sympathetic spirit in which he has dealt with them. In one respect, however, M. Laugel conveys to his readers an erroneous impression—an impression doubtless derived from what appears to him adequate evidence, and doubtless expressed in perfect sincerity. M. Laugel describes me as being, in part, a follower of M. Comte. After describing the influence of M. Comte as traceable in the works of some other English writers, naming especially Mr. Mill and Mr. Buckle, he goes on to say that this influence, though not avowed, is easily recognizable in the work he is about to make known; and in several places throughout his review, there are remarks having the same implication. I greatly regret having to take exception to anything said by a critic so candid and so able. But the *Revue des Deux Mondes* circulates widely in England, as well as elsewhere; and finding that there exists in some minds, both here and in America, an impression similar to that entertained by M. Laugel—an impression likely to be confirmed by his statement—it appears to me needful to meet it.

Two causes of quite different kinds, have conspired to diffuse the erroneous belief that M. Comte is an accepted exponent of scientific opinion. His bitterest foes and his closest friends, have unconsciously joined in propagating it. On the one hand, M. Comte having designated by the term "Positive Philosophy" all that definitely-established knowledge which men of science have been gradually organizing into a coherent body of doctrine; and having habitually placed this in opposition to the incoherent body of doctrine defended by theologians; it has become the habit of the theological party to think of the antagonist scientific party, under the title of "positivists." And thus, from the habit of calling them "positivists," there has grown up the assumption that they call themselves "positivists," and that they are the disciples of M. Comte. On the other hand, those who have accepted M. Comte's system, and believe it to be the philosophy of the future, have naturally been prone to see everywhere the signs of its progress; and wherever they have found opinions in harmony with it, have ascribed these opinions to the influence of its originator. It is always the tendency of discipleship to magnify the effects of the master's teachings; and to credit the master with all the doctrines he teaches. In the minds of his followers, M. Comte's name is associated with scientific thinking, which, in many cases, they first understood from his exposition of it. Influenced as they inevitably are by this association of ideas, they are reminded of M. Comte wherever they meet with thinking which corresponds, in some marked way, to M. Comte's description of scientific thinking; and hence are apt to imagine him as introducing into other minds, the conceptions which he introduced into their minds. Such impressions are, however, in most cases quite unwarranted. That M. Comte has given a general exposition of the doctrine and method elaborated by Science, is true. But it is not true that the holders of this doctrine and followers of this method,

are disciples of M. Comte. Neither their modes of inquiry nor their views concerning human knowledge in its nature and limits, are appreciably different from what they were before. If they are "positivists," it is in the sense that all men of science have been more or less consistently "positivists;" and the applicability of M. Comte's title to them, no more makes them his disciples, than does its applicability to men of science who lived and died before M. Comte wrote, make these his disciples. M. Comte himself by no means claims that which some of his adherents are apt, by implication, to claim for him. He says:—"Il y a, sans doute, beaucoup d'analogie entre ma *philosophie positive* et ce que les savans anglais entendent, depuis Newton surtout, par *philosophie naturelle*;" (see *Avertissement)* and further on he indicates the "grand mouvement imprimé à l'esprit humain, il y a deux siècles, par l'action combinée des préceptes de Bacon, des conceptions de Descartes, et des découvertes de Galileé, comme le moment où l'esprit de la philosophie positive a commencé à se prononcer dans le monde." That is to say, the general mode of thought and way of interpreting phenomena, which M. Comte calls "Positive Philosophy," he recognizes as having been growing for two centuries; as having reached, when he wrote, a marked development; and as being the heritage of all men of science.

That which M. Comte proposed to do, was to give scientific thought and method a more definite embodiment and organization; and to apply it to the interpretation of classes of phenomena not previously dealt with in a scientific manner The conception was a great one; and the endeavour to work it out was worthy of sympathy and applause. Some such conception was entertained by Bacon. He, too, aimed at the organization of the sciences; he, too, held that "Physics is the mother of all the sciences;" he, too, held that the sciences can be advanced only by combining them,

and saw the nature of the required combination; he, too, held that moral and civil philosophy could not flourish when separated from their roots in natural philosophy; and thus he, too, had some idea of a social science growing out of physical science. But the state of knowledge in his day prevented any advance beyond the general conception: indeed, it was marvellous that he should have advanced so far. Instead of a vague, undefined conception, M. Comte has presented the world with a defined and highly-elaborated conception. In working out this conception he has shown remarkable breadth of view, great originality, immense fertility of thought, unusual powers of generalization. Considered apart from the question of its truth, his system of Positive Philosophy is a vast achievement. But after according to M. Comte high admiration for his conception, for his effort to realize it, and for the faculty he has shown in the effort to realize it, there remains the inquiry—Has he succeeded? A thinker who re-organizes the scientific method and knowledge of his age, and whose re-organization is accepted by his successors, may rightly be said to have such successors for his disciples. But successors who accept this method and knowledge of his age, *minus* his re-organization, are certainly not his disciples. How then stands the case with M. Comte? There are some few who receive his doctrines with but little reservation; and these are his disciples truly so called. There are others who regard with approval certain of his leading doctrines, but not the rest: these we may distinguish as partial adherents. There are others who reject all his distinctive doctrines; and these must be classed as his antagonists. The members of this class stand substantially in the same position as they would have done had he not written. Declining his re-organization of scientific doctrine, they possess this scientific doctrine in its pre-existing state, as the common heritage bequeathed by the past to the present; and their adhesion to

this scientific doctrine in no sense implicates them with M. Comte. In this class stand the great body of men of science. And in this class I stand myself.

Coming thus to the personal part of the question, let me first specify those great general principles on which M. Comte is at one with preceding thinkers: and on which I am at one with M. Comte.

All knowledge is from experience, holds M. Comte; and this I also hold—hold it, indeed, in a wider sense than M. Comte: since, not only do I believe that all the ideas acquired by individuals, and consequently all the ideas transmitted by past generations, are thus derived; but I also contend that the very faculties by which they are acquired, are the products of accumulated and organized experiences received by ancestral races of beings (see *Principles of Psychology*). But the doctrine that all knowledge is from experience, is not originated by M. Comte; nor is it claimed by him. He himself says—"Tous les bons esprits répètent, depuis Bacon, qu'il n'y a de connaissances réelle que celles qui reposent sur des faites observés." And the elaboration and definite establishment of this doctrine, has been the special characteristic of the English school of Psychology. Nor am I aware that M. Comte, accepting this doctrine, has done anything to make it more certain, or give it greater definiteness. Indeed it was impossible for him to do so; since he repudiates that part of mental science by which alone this doctrine can be proved.

It is a further belief of M. Comte, that all knowledge is phenomenal or relative; and in this belief I entirely agree. But no one alleges that the relativity of all knowledge was first enunciated by M. Comte. Among others who have more or less consistently held this truth, Sir William Hamilton enumerates, Protagoras, Aristotle, St. Augustin, Boethius, Averroes, Albertus Magnus, Gerson, Leo Hebræus, Melancthon, Scaliger, Francis Piccolomini, Giordano Bruno, Cam-

panella, Bacon, Spinoza, Newton, Kant. And Sir William Hamilton, in his "Philosophy of the Unconditioned," first published in 1829, has given a scientific demonstration of this belief. Receiving it in common with other thinkers, from preceding thinkers, M. Comte has not, to my knowledge, advanced this belief. Nor indeed could he advance it, for the reason already given—he denies the possibility of that analysis of thought which discloses the relativity of all cognition.

M. Comte reprobates the interpretation of different classes of phenomena by assigning metaphysical entities as their causes; and I coincide in the opinion that the assumption of such separate entities, though convenient, if not indeed necessary, for purposes of thought, is, scientifically considered, illegitimate. This opinion is, in fact, a corollary from the last; and must stand or fall with it. But like the last it has been held with more or less consistency for generations. M. Comte himself quotes Newton's favorite saying —"O! Physics, beware of Metaphysics!" Neither to this doctrine, any more than to the preceding doctrines, has M. Comte given a firmer basis. He has simply re-asserted it; and it was out of the question for him to do more. In this case, as in the others, his denial of subjective psychology debarred him from proving that these metaphysical entities are mere symbolic conceptions which do not admit of verification.

Lastly, M. Comte believes in invariable natural laws—absolute uniformities of relation among phenomena. But very many before him have believed in them too. Long familiar even beyond the bounds of the scientific world, the proposition that there is an unchanging order in things, has, within the scientific world, held, for generations, the position of an established postulate: by some men of science recognized only as holding of inorganic phenomena; but recognized by other men of science, as universal. And M. Comte, accepting this doctrine from the past, has left it substantially

as it was. Though he has asserted new uniformities, I do not think scientific men will admit that he has so *demonstrated* them, as to make the induction more certain; nor has he deductively established the doctrine, by showing that uniformity of relation is a necessary corollary from the persistence of force, as may readily be shown.

These, then, are the pre-established general truths with which M. Comte sets out—truths which cannot be regarded as distinctive of his philosophy. "But why," it will perhaps be asked, "is it needful to point out this; seeing that no instructed reader supposes these truths to be peculiar to M. Comte?" I reply that though no disciple of M. Comte would deliberately claim them for him; and though no theological antagonist at all familiar with science and philophy, supposes M. Comte to be the first propounder of them; yet there is so strong a tendency to associate any doctrines with the name of a conspicuous recent exponent of them, that false impressions are produced, even in spite of better knowledge. Of the need for making this reclamation, definite proof is at hand. In the No. of the *Revue des Deux Mondes* named at the commencement, may be found, on p. 936, the words—"Toute religion, comme toute philosophie, a la prétention de donner une explication de l'univers. La philosophie qui s'appelle *positive* se distingue de toutes les philosophies et de toutes les religions en ce qu'elle a renoncé à cette ambition de l'esprit humain;" and the remainder of the paragraph is devoted to explaining the doctrine of the relativity of knowledge. The next paragraph begins—"Tout imbu de ces idées, que nous exposons sans les discuter pour le moment, M. Spencer divise, etc." Now this is one of those collocations of ideas which tends to create, or to strengthen, the erroneous impression I would dissipate. I do not for a moment suppose that M. Laugel intended to say that these ideas which he describes as ideas of the "Positive Philosophy," are peculiarly the ideas of M. Comte. But

little as he probably intended it, his expressions suggest this conception. In the minds of both disciples and antagonists, "the Positive Philosophy" means the philosophy of M. Comte; and to be imbued with the ideas of "the Positive Philosophy" means to be imbued with the ideas of M. Comte —to have received these ideas from M. Comte. After what has been said above, I need scarcely repeat that the conception thus inadvertently suggested, is a wrong one. M. Comte's brief enunciations of these general truths, gave me no clearer apprehensions of them than I had before. Such clarifications of ideas on these ultimate questions, as I can trace to any particular teacher, I owe to Sir William Hamilton

From the principles which M. Comte held in common with many preceding and contemporary thinkers, let us pass now to the principles that are distinctive of his system. Just as entirely as I agree with M. Comte on those cardinal doctrines which we jointly inherit; so entirely do I disagree with him on those cardinal doctrines which he propounds, and which determine the organization of his philosophy. The best way of showing this will be to compare, side by side, the—

Propositions held by M. Comte.	*Propositions which I hold.*
"... chacune de nos conceptions principales, chaque branche de nos connaissances, passe successivement par trois états théoriques différens: l'état théologique, ou fictif; l'état métaphysique, ou abstrait; l'état scientifique, ou positif. En d'autres termes, l'esprit humain, par sa nature, emploie successivement dans chacune de ses recherches trôis méthodes de philoso-	The progress of our conceptions, and of each branch of knowledge, is from beginning to end intrinsically alike. There are not three methods of philosophizing radically opposed; but one method of philosophizing which remains, in essence, the same. At first, and to the last, the conceived causal agencies of phenomena, have a degree of generality corresponding to the width of the generalizations which experiences have determined; and they change just as gradually as experiences accumulate. The inte-

pher, dont le caractère est essentiellement différent et même radicalement opposé : d'abord la méthode théologique, ensuite la méthode métaphysique, et enfin la méthode positive." p. 3.

gration of causal agencies, originally thought of as multitudinous and local, but finally believed to be one and universal, is a process which involves the passing through all intermediate steps between these extremes; and any appearance of stages can be but superficial. Supposed concrete and individual causal agencies, coalesce in the mind as fast as groups of phenomena are assimilated, or seen to be similarly caused. Along with their coalescence, comes a greater extension of their individualities, and a concomitant loss of distinctness in their individualities. Gradually, by continuance of such coalescences, causal agencies become, in thought, diffused and indefinite. And eventually, without any change in the nature of the process, there is reached the consciousness of a universal causal agency, which cannot be conceived.*

'Le système théologique est parvenu à la plus haute perfection dont il soit susceptible, quand il a substitué l'action providentielle d'un être unique au jeu varié des nombreuses divinités indépendantes qui avaient été imaginées primitivement. De même, le dernier terme du système metaphysique consiste à concevoir, au lieu des différentes entités particulières,

As the progress of thought is one, so is the end one. There are not three possible terminal conceptions; but only a single terminal conception. When the theological idea of the providential action of one being, is developed to its ultimate form, by the absorption of all independent secondary agencies, it becomes the conception of a being immanent in all phenomena; and the reduction of it to this state, implies the fading-away, in thought, of all those anthropomorphic attributes by which the aboriginal

* A clear illustration of this process, is furnished by the recent mental integration of Heat, Light, Electricity, etc., as modes of molecular motion. If we go a step back, we see that the modern conception of Electricity, resulted from the integration in consciousness, of the two forms of it evolved in the galvanic battery and in the electric-machine. And going back to a still earlier stage, we see how the conception of statical electricity, arose by the coalescence in thought, of the previously-separate forces manifested in rubbed amber, in rubbed glass, and in lightning. With such illustrations before him, no one can, I think, doubt that the process has been the same from the beginning.

une seule grande entité générale, la *nature*, envisagée comme la source unique de tous les phénomènes. Pareillement, la perfection du système positif, vers laquelle il tend sans cesse, quoiqu'il soit très-probable qu'il ne doive jamais l'atteindre, serait de pouvoir se représenter tous les divers phénomènes observables comme des cas particuliers d'un seul fait général, tel que celui de la gravitation, par exemple." p. 5.

idea was distinguished. The alleged last term of the metaphysical system —the conception of a single great general entity, *nature*, as the source of all phenomena—is a conception identical with the previous one: the consciousness of a single source which, in coming to be regarded as universal, ceases to be regarded as conceivable, differs in nothing but name from the consciousness of one being, manifested in all phenomena. And similarly, that which is described as the ideal state of science—the power to represent all observable phenomena as particular cases of a single general fact, implies the postulating of some ultimate existence of which this single fact is alleged; and the postulating of this ultimate existence, involves a state of consciousness indistinguishable from the other two.

... la perfection du système positif, vers laquelle il tend sans cesse, quoiqu'il soit très-probable qu'il ne doive jamais l'atteindre, serait de pouvoir se représenter tous les divers phénomènes observables comme des cas particuliers d'un seul fait général. p. 5 . . . . . considérant comme absolument inaccessible, et vide de sens pour nous la recherche de ce qu'on appelle les *causes*, soit premières, soit finales." p. 14.

Though along with the extension of generalizations, and concomitant integration of conceived causal agencies, the conceptions of causal agencies grow more indefinite; and though as they gradually coalesce into a universal causal agency, they cease to be representable in thought, and are no longer supposed to be comprehensible; yet the consciousness of *cause* remains as dominant to the last as it was at first; and can never be got rid of. The consciousness of cause can be abolished only by abolishing consciousness itself.* (*First Principles*, § 26.)

* Possibly it will be said that M. Comte himself admits, that what he calls the perfection of the positive system, will probably never be reached; and that what he condemns is the inquiry into the *natures* of causes and not the general recognition of cause. To the first of these allegations, I reply that, as I understand M. Comte, the obstacle to the perfect realization of the positive philosophy is the impossibility of carrying generalization so far as to reduce all particular facts to

"Ce n'est pas aux lecteurs de cet ouvrage que je croirai jamais devoir prouver que les idées gouvernent et bouleversent le monde, ou, en d'autres termes, que tout le mécanisme social repose finalement sur des opinions. Ils savent surtout que la grande crise politique et morale des sociétés actuelles tient, en dernière analyse, à l'anarchie intellectuelle." p. 48.*

Ideas do not govern and overthrow the world: the world is governed or overthrown by feelings, to which ideas serve only as guides. The social mechanism does not rest finally upon opinions; but almost wholly upon character. Not intellectual anarchy, but moral antagonism, is the cause of political crises. All social phenomena are produced by the totality of human emotions and beliefs: of which the emotions are mainly pre-determined, while the beliefs are mainly post-determined. Men's desires are chiefly inherited; but their beliefs are chiefly acquired, and depend on surrounding conditions; and the most important surrounding conditions depend on the social state which the prevalent desires have produced. The social state at any time existing, is the resultant of all the ambitions, self-interests, fears, reverences, indignations, sympathies, etc., of ancestral citizens and existing citizens. The ideas current in this social state, must, on the average, be congruous with the feelings of citizens; and therefore, on the average, with the social state these feelings have pro-

cases of one general fact—not the impossibility of excluding the consciousness of cause. And to the second allegation I reply, that the essential principle of his philosophy, is an avowed ignoring of cause altogether. For if it is not, *what becomes of his alleged distinction between the perfection of the positive system and the perfection of the metaphysical system?* And here let me point out that, by affirming exactly the opposite to that which M. Comte thus affirms, I am excluded from the positive school. If his own definition of positivism is to be taken, then, as I hold that what he defines as positivism is an absolute impossibility, it is clear that I cannot be what he calls a positivist.

* A friendly critic alleges that M. Comte is not fairly represented by this quotation, and that he is blamed by his biographer, M. Littré, for his too-great insistance on feeling as a motor of humanity. If in his "Positive Politics," which I presume is here referred to, M. Comte abandons his original position, so much the better. But I am here dealing with what is known as "the Positive Philosophy;" and that the passage above quoted does not misrepresent it, is proved by the fact that this doctrine is re-asserted at the commencement of the Sociology.

duced. Ideas wholly foreign to this social state cannot be evolved, and if introduced from without, cannot get accepted—or, if accepted, die out when the temporary phase of feeling which caused their acceptance, ends. Hence, though advanced ideas when once established, act upon society and aid its further advance; yet the establishment of such ideas depends on the fitness of the society for receiving them. Practically, the popular character and the social state, determine what ideas shall be current; instead of the current ideas determining the social state and the character. The modification of men's moral natures, caused by the continuous discipline of social life, which adapts them more and more to social relations, is therefore the chief proximate cause of social progress. (*Social Statics*, chap. xxx.)

"...Je ne dois pas négliger d'indiquer d'avance, comme une propriété essentielle de l'échelle encyclopédique que je vais proposer, sa conformité générale avec l'ensemble de l'histoire scientifique; en ce sens, que, malgré la simultanéité réelle et continue du développement des différentes sciences, celles qui seront classées comme antérieures seront, en effet, plus anciennes et constamment plus avancées que celles présentées comme postérieures." p. 84. . . . . "Cet ordre est déterminé par le degré de simplicité, ou, ce qui revient au même, par le degré de généralité des phénomènes." p. 87.

The order in which the generalizations of science are established, is determined by the frequency and impressiveness with which different classes of relations are repeated in conscious experience; and this depends, partly on *the directness with which personal welfare is affected;* partly on *the conspicuousness of one or both the phenomena between which a relation is to be perceived;* partly on *the absolute frequency with which the relations occur;* partly on their *relative frequency of occurrence;* partly on their *degree of simplicity;* and partly on their *degree of abstractness.* (*First Principles*, 1st ed., § 36; appended to this pamphlet.)

"En résultat définitif, la mathématique, l'astronomie, la physique, la chimie, la physiologie, et la physique sociale; telle est la formule enclyopédique qui, parmi le très-grand nombre de classifications que comportent les six sciences fondamentales, est seule logiquement conforme à la hiérarchie naturelle et invariable des phénomènes." p. 115.

The sciences as arranged in this succession specified by M. Comte, *do not* logically conform to the natural and invariable hierarchy of phenomena; and there is no serial order whatever in which they can be placed, which represents either their logical dependence or the dependence of phenomena. (See *Genesis of Science*, and foregoing Essay.)

"On conçoit, en effet, que l'étude rationelle de chaque science fondamentale exigeant la culture préalable de toutes celles qui la précèdent dans notre hiérarchie enclyopédique, n'a pu faire de progrès réels et prendre son véritable caractère, qu' après un grand développement des sciences antérieures relatives à des phénomènes plus généraux, plus abstraits, moins compliqués, et indépendans des autres. C'est donc dans cet ordre que la progression, quoique simultanée, a dû avoir lieu." p. 100.

The historical development of the sciences *has not* taken place in this serial order; nor in any other serial order. There is no "true *filiation* of the sciences." From the beginning, the abstract sciences, the abstract-concrete sciences, and the concrete sciences, have progressed together: the first solving problems which the second and third presented, and growing only by the solution of the problems; and the second similarly growing by joining the first in solving the problems of the third. All along there has been a continuous action and reaction between the three great classes of sciences—an advance from concrete facts to abstract facts, and then an application of such abstract facts to the analysis of new orders of concrete facts. (See *Genesis of Science.*)

Such then are the organizing principles of M. Comte's philosophy. Leaving out of his "*Exposition*" those pre-established general doctrines which are the common property of modern thinkers; these are the general doctrines which remain—these are the doctrines which fundamentally distinguish his system. From every one of them I dissent. To each proposition I oppose either a widely-different pro-

position, or a direct negation; and I not only do it now, but have done it from the time when I became acquainted with his writings. This rejection of his cardinal principles should, I think, alone suffice; but there are sundry other views of his, some of them largely characterizing his system, which I equally reject. Let us glance at them.

How organic beings have originated, is an inquiry which M. Comte deprecates as a useless speculation: asserting, as he does, that species are immutable.

This inquiry, I believe, admits of answer, and will be answered. That division of Biology which concerns itself with the origin of species, I hold to be the supreme division, to which all others are subsidiary. For on the verdict of Biology on this matter, must wholly depend our conception of human nature, past, present, and future; our theory of the mind; and our theory of society.

M. Comte contends that of what is commonly known as mental science, all that most important part which consists of the subjective analysis of our ideas, is an impossibility.

I have very emphatically expressed my belief in a subjective science of the mind, by writing a *Principles of Psychology*, one half of which is subjective.

M. Comte's ideal of society is one in which *government* is developed to the greatest extent—in which class-functions are far more under conscious public regulation than now—in which hierarchical organization with unquestioned authority shall guide everything—in which the individual life shall be subordinated in the greatest degree to the social life.

That form of society towards which we are progressing, I hold to be one in which *government* will be reduced to the smallest amount possible, and *freedom* increased to the greatest amount possible — one in which human nature will have become so moulded by social discipline into fitness for the social state, that it will need little external restraint, but will be self-restrained—one in which the citizen will tolerate no interference with his freedom, save that which maintains the equal freedom of others —one in which the spontaneous co-operation which has developed our industrial system, and is now develop-

ing it with increasing rapidity, will produce agencies for the discharge of nearly all social functions, and will leave to the primary govermental agency nothing beyond the function of maintaining those conditions to free action, which make such spontaneous co-operation possible—one in which individual life will thus be pushed to the greatest extent consistent with social life; and in which social life will have no other end than to maintain the completest sphere for individual life.

M. Comte, not including in his philosophy the consciousness of a cause manifested to us in all phenomena, and yet holding that there must be a religion, which must have an object, takes for his object —Humanity. "This Collective Life (of Society) is in Comte's system the *Être Suprême;* the only one we can *know*, therefore the only one we can worship."

I conceive, on the other hand, that the object of religious sentiment will ever continue to be, that which it has ever been—the unknown source of things. While the *forms* under which men are conscious of the unknown source of things, may fade away, the *substance* of the consciousness is permanent. Beginning with causal agents conceived as imperfectly known; progressing to causal agents conceived as less known and less knowable; and coming at last to a universal causal agent posited as not to be known at all; the religious sentiment must ever continue to occupy itself with this universal causal agent. Having in the course of evolution, come to have for its object of contemplation, the Infinite Unknowable, the religious sentiment can never again (unless by retrogression) take a Finite Knowable, like Humanity, for its object of contemplation.

Here, then, are sundry other points, all of them important, and the last two supremely important, on which I am diametrically opposed to M. Comte; and did space permit, I could add many others. Radically differing from him as I thus do, in everything distinctive of his philosophy; and

having invariably expressed my dissent, publicly and privately, from the time I became acquainted with his writings; it may be imagined that I have been not a little startled to find myself classed as one of the same school. That those who have read *First Principles* only, may have been betrayed into this error in the way above shown, by the ambiguous use of the phrase "Positive Philosophy," I can understand. But that any who are acquainted with my previous writings, should suppose I have any general sympathy with M. Comte, save that implied by preferring proved facts to superstitions, astonishes me.

It is true that, disagreeing with M. Comte, though I do, in all those fundamental views that are peculiar to him, I agree with him in sundry minor views. The doctrine that the education of the individual should accord in mode and arrangement with the education of mankind, considered historically, I have cited from him; and have endeavoured to enforce it. I entirely concur in his opinion that there requires a new order of scientific men, whose function shall be that of co-ordinating the results arrived at by the rest. To him I believe I am indebted for the conception of a social *consensus*; and when the time comes for dealing with this conception, I shall state my indebtedness. And I also adopt his word, Sociology. There are, I believe, in the part of his writings which I have read, various incidental thoughts of great depth and value; and I doubt not that were I to read more of his writings, I should find many others.* It is very probable, too, that I have said (as I am told I have) some things which M. Comte had already said. It would be difficult, I believe, to find any two men who had no opinions in common. And it would be extremely strange if two men,

* M. Comte's "Exposition" I read in the original in 1853; and in two or three other places have referred to the original to get his exact words. The Inorganic Physics, and the first chapter of the Biology, I read in Miss Martineau's condensed translation, when it appeared. The rest of M. Comte's views I know only through Mr. Lewes's outline, and through incidental references.

starting from the same general doctrines established by modern science, should traverse some of the same fields of inquiry, without their lines of thought having any points of intersection. But none of these minor agreements can be of much weight in comparison with the fundamental disagreements above specified. Leaving out of view that general community which we both have with the scientific thought of the age, the differences between us are essential, while the correspondences are non-essential. And I venture to think that kinship must be determined by essentials, and not by non-essentials.*

Joined with the ambiguous use of the phrase "Positive Philosophy," which has led to a classing with M. Comte of many men who either ignore or reject his distinctive principles, there has been one special circumstance that has tended to originate and maintain this classing in my own case. The assumption of some relationship between M. Comte and myself, was unavoidably raised by the title of my first book—*Social Statics*. When that book was published, I was unaware that this title had been before used: had I known the fact, I should certainly have adopted an alternative title which I had in view.† If, however, instead of the title,

* In his recent work, *Auguste Comte et la Philosophie Positive*, M. Littré, defending the Comtean classification of the sciences from the criticism I made upon it in the "Genesis of Science," deals with me wholly as an antagonist. The chapter he devotes to his reply, opens by placing me in direct antithesis to the English adherents of Comte, named in the preceding chapter.

† I believed at the time, and have never doubted until now, that the choice of this title was absolutely independent of its previous use by M. Comte. While writing these pages, I have found reason to think the contrary. On referring to *Social Statics*, to see what were my views of social evolution in 1850, when M. Comte was to me but a name, I met with the following sentence:—"Social philosophy may be aptly divided (as political economy has been) into statics and dynamics." (p. 409). This I remembered to be a reference to a division which I had seen in the Political Economy of Mr. Mill. But why had I not mentioned Mr. Mill's name? On referring to the first edition of his work, I found, at the opening of Book iv., this sentence:—"The three preceding parts include as detailed a view as the limits of this treatise permit, of what, by a happy generalization of a mathematical phrase, has been called the Statics of the subject." Here was the solution of the question. The division had not been made by Mr. Mill, but by some writer (on Political Economy I supposed) who was not named by him; and whom I did not know. It is now manifest, however, that while I supposed I was giving a more extended use to this division, I was but returning to the original use

the work itself be considered, its irrelation to the philosophy of M. Comte, becomes abundantly manifest. There is decisive testimony on this point. In the *North British Review* for August, 1851, a reviewer of *Social Statics* says—

"The title of this work, however, is a complete misnomer. According to all analogy, the phrase "Social Statics" should be used only in some such sense as that in which, as we have already explained, it is used by Comte, namely as designating a branch of inquiry whose end it is to ascertain the laws of social equilibrium or order, as distinct ideally from those of social movement or progress. Of this Mr. Spencer does not seem to have had the slightest notion, but to have chosen the name for his work only as a means of indicating vaguely that it proposed to treat of social concerns in a scientific manner." p. 321.

Respecting M. Comte's application of the words *statics* and *dynamics* to social phenomena, now that I know what it is, I will only say that while I perfectly understand how, by a defensible extension of their mathematical meanings, the one may be used to indicate social *functions in balance*, and the other social *functions out of balance*, I am quite at a loss to understand how the phenomena of *structure* can be included in the one any more than in the other. But the two things which here concern me, are, first, to point out that I had not "the slightest notion" of giving Social Statics the meaning which M. Comte gave it; and, second, to explain the meaning which I did give it. The units of any aggregate of matter, are in equilibrium when they severally act and re-act upon each other on all sides with equal forces. A state of change among them implies that there are forces exercised by some that are not counterbalanced by like forces exercised by others; and a state of rest implies the absence of such uncounterbalanced forces—implies, if the units are homogeneous, equal distances among them—implies a maintenance of their respective spheres of molecular

which Mr. Mill had limited to his special topic. Another thing is, I think, tolerably manifest. As I evidently wished to point out my obligation to some unknown political economist, whose division I thought I was extending, I should have named him had I known who he was. And in that case should not have put this extension of the division as though it were new

tion, is traceable through successive stages. It may be seen in the last paragraph of an essay on "The Philosophy of Style," published in October, 1852; again in an essay on "Manners and Fashion," published in April, 1854; and then, in a comparatively advanced form, in an essay on "Progess: its Law and Cause," published in April, 1857. Afterwards, there came the recognition of the need for further limitation of this formula; next the inquiry into those general laws of force from which this universal transformation necessarily results; next the deduction of these from the ultimate law of the persistence of force; next the perception that there is everywhere a process of Dissolution complementary to that of Evolution; and, finally, the determination of the conditions (specified in the foregoing essay) under which Evolution and Dissolution respectively occur. The filiation of these results, is, I think, tolerably manifest. The process has been one of continuous development, set up by the addition of Von Baer's law to a number of ideas that were in harmony with it. And I am not conscious of any other influences by which the process has been affected.

It is possible, however, that there may have been influences of which I am not conscious; and my opposition to M. Comte's system may have been one of them. The presentation of antagonistic thoughts, often produces greater definiteness and development of one's own thoughts. It is probable that the doctrines set forth in the essay on "The Genesis of Science," might never have been reached, had not my very decided dissent from M. Comte's conception, led me to work them out; and but for this, I might not have arrived at the classification of the sciences exhibited in the foregoing essay. Very possibly there are other cases in which the stimulus of repugnance to M. Comte's views, may have aided in elaborating my own views; though I cannot call to mind any other cases.

Let it by no means be supposed from all I have said, that I do not regard M. Comte's speculations as of great value.

this incidental agreement, however, the ... produced *Statics* are so wholly antagonistic to ... thought in many M. Comte, that, but for the title, the ... more. Doubtless, I think, have raised the remembrance of ... from his general views, by the association of opposites.*

And now let me point out that which ... consideration of them. a profound influence over my course of ... knowledge and method as a which Harvey's embryological inquiries ... co-ordinated, cannot have which was afterwards more clearly per... ...ions of most of his readers. which was put into a definite shape by ... by familiarizing men with that all organic development is a cha... ...d on the other sciences. homogeneity to a state of heterogen... ...ws the general character which very many of the conclusions ... that there are scattered have indirectly resulted. In *Social S*... ...that are valuable not where manifested a dominant belief in ... such. and of society. There is also manifest... ...task to make these evolution is in both cases determined ... ...d to me a task not to conditions—the actions of circumsta... ...as I do from M. Comte further, in the sections above referred ... which we inherit in the fact that organic and social evolu... ...needful to dissipate same law. Falling amid beliefs in ... ...needful to show that orders, everywhere determined by natur... ...known as "positive displayed in the *Theory of Populatio*... ...gy" in the sense of *of Psychology*); the formula of Ve... ...; and to show that organizing principle. The extension ... ...positive philosophy" of phenomena than those of individu... ...from it.

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* Let me add that the conception developed in ... series of letters on the "Proper Sphere of Go... *Nonconformist* newspaper, in the latter half of ... pamphlet in 1843. In these letters will be found ... the same belief in the conformity of social phen... same belief in human progression as determined ... in the moral modification of men as caused by ... belief in the tendency of social arrangemen... a condition of *stable* equilibrium;" the same re... various departments of social life; the same li... maintenance of equitable relations among citizens ... arose from a dissatisfaction with the basis on whic... letters were placed: the second half of that w... doctrines; and the first half a statement of the ... deducible.

X.

... in the first edition of ... the re-appearance ... essential part of the work ... the foregoing pages, and as ... to the contents of those pages, ... it here. Moreover, though ... it in that division of the Prin- ... treats of Intellectual Progress, ... it can thus re-appear in its pre- ... I not get so far in the execution ... ever thus re-appear at all, it seems ... possible than it is at present. The ... seemed to link it into the argument ... originally belonged, are omitted. The ... revised, and in some parts considerably

LAWS IN GENERAL.

... of Law being the recognition of uni- ... among phenomena, it follows that the ... erent groups of phenomena are reduced to ... on the frequency with which the uniform ... verally display are distinctly experienced. ... age of progress, those uniformities will be ... which men's minds have been oftenest and ... impressed. In proportion partly to the ... es a relation has been presented to con- ... merely to the senses), and in proportion

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... classes formerly of relations ... — I see things related ... by by compulsion of law —

True or untrue, his system as a whole, has doubtless produced important and salutary revolutions of thought in many minds; and will doubtless do so in many more. Doubtless, too, not a few of those who dissent from his general views, have been heathfully stimulated by the consideration of them. The presentation of scientific knowledge and method as a whole, whether rightly or wrongly co-ordinated, cannot have failed greatly to widen the conceptions of most of his readers. And he has done especial service by familiarizing men with the idea of a social science, based on the other sciences. Beyond which benefits resulting from the general character and scope of his philosophy, I believe that there are scattered through his pages, many large ideas that are valuable not only as stimuli, but for their actual truth.

It has been by no means an agreeable task to make these personal explanations; but it has seemed to me a task not to be avoided. Differing so profoundly as I do from M. Comte on all fundamental doctrines, save those which we inherit in common from the past; it has become needful to dissipate the impression that I agree with him—needful to show that a large part of what is currently known as "positive philosophy," is not "positive philosophy" in the sense of being peculiarly M. Comte's philosophy; and to show that beyond that portion of the so-called "positive philosophy" which is not peculiar to him, I dissent from it.

And now at the close, as at the outset, let me express my great regret that these explanations should have been called forth by the statements of a critic who has treated me so liberally. Nothing will, I fear, prevent the foregoing pages from appearing like a very ungracious response to M. Laugel's sympathetically-written review. I can only hope that the gravity of the question at issue, in so far as it concerns myself, may be taken in mitigation, if not as a sufficient apology.

March 12th, 1864.

APPENDIX.

[*The following chapter was contained in the first edition of* First Principles. *I omitted it from the re-organized second edition, because it did not form an essential part of the new structure. As it is referred to in the foregoing pages, and as its general argument is germane to the contents of those pages, I have thought well to append it here. Moreover, though I hope eventually to incorporate it in that division of the* Principles of Sociology *which treats of Intellectual Progress, yet as it must be long before it can thus re-appear in its permanent place, and as, should I not get so far in the execution of my undertaking, it may never thus re-appear at all, it seems proper to make it more accessible than it is at present. The first and last sections, which served to link it into the argument of the work to which it originally belonged, are omitted. The rest has been carefully revised, and in some parts considerably altered.*]

LAWS IN GENERAL.

The recognition of Law being the recognition of uniformity of relations among phenomena, it follows that the order in which different groups of phenomena are reduced to law, must depend on the frequency with which the uniform relations they severally display are distinctly experienced. At any given stage of progress, those uniformities will be best known with which men's minds have been oftenest and most strongly impressed. In proportion partly to the number of times a relation has been presented to consciousness (not merely to the senses), and in proportion

partly to the vividness with which the terms of the relation have been cognized, will be the degree in which the constancy of connexion is perceived.

The succession in which relations are generalized being thus determined, there result certain derivative principles to which this succession must more immediately and obviously conform. First is *the directness with which personal welfare is affected.* While, among surrounding things, many do not appreciably influence us in any way, some produce pleasures and some pains, in various degrees; and manifestly, those things whose actions on the organism for good or evil are most decided, will, cæteris paribus, be those whose laws of action are earliest observed. Second comes *the conspicuousness of one or both phenomena between which a relation is to be perceived.* On every side are phenomena so concealed as to be detected only by close observation; others not obtrusive enough to attract notice; others which moderately solicit the attention; others so imposing or vivid as to force themselves on consciousness; and, supposing conditions to be the same, these last will of course be among the first to have their relations generalized. In the third place, we have *the absolute frequency with which the relations occur.* There are coexistences and sequences of all degrees of commonness, from those which are ever present to those which are extremely rare; and manifestly, the rare coexistences and sequences, as well as the sequences which are very long in taking place, will not be reduced to law so soon as those which are familiar and rapid. Fourthly has to be added *the relative frequency of occurrence.* Many events and appearances are limited to certain times or certain places, or both; and, as a relation which does not exist within the environment of an observer cannot be perceived by him, however common it may be elsewhere or in another age, we have to take account of the surrounding physical circum-

stances, as well as of the state of society, of the arts, and of the sciences—all of which affect the frequency with which certain groups of facts are observable. The fifth corollary to be noticed is, that the succession in which different classes of relations are reduced to law, depends in part on their *simplicity*. Phenomena presenting great composition of causes or conditions, have their essential relations so masked, that it requires accumulated experiences to impress upon consciousness the true connexions of antecedents and consequents they involve. Hence, other things equal, the progress of generalization will be from the simple to the complex; and this it is which M. Comte has wrongly asserted to be the sole regulative principle of the progress. Sixth comes *the degree of abstractness*. Concrete relations are the earliest acquisitions. Such analyses of them as separate the essential connexions from their disguising accompaniments, necessarily come later. The analyses of the connexions, always more or less compound, into their elements then becomes possible. And so on continually, until the highest and most abstract truths have been reached.

These, then, are the several derivative principles. The frequency and vividness with which uniform relations are repeated in conscious experience, determining the recognition of their uniformity, and this frequency and vividness depending on the above conditions, it follows that the order in which different classes of facts are generalized, must depend on the extent to which the above conditions are fulfilled in each class. Let us mark how the facts harmonize with this conclusion: taking first a few that elucidate the general truth, and afterwards some that exemplify the special truths which we here see follow from it.

The relations earliest known as uniformities, are those subsisting between the common properties of matter—tangi-

bility, visibility, cohesion, weight, etc. We have no trace of a time when the resistance offered by an object was regarded as caused by the will of the object; or when the pressure of a body on the hand holding it, was ascribed to the agency of a living being. And accordingly, these are the relations of which we are oftenest conscious; being objectively frequent, conspicuous, simple, concrete, and of immediate personal concern.

Similarly with the ordinary phenomena of motion. The fall of a mass on the withdrawal of its support, is a sequence which directly affects bodily welfare, is conspicuous, simple, concrete, and very often repeated. Hence it is one of the uniformities recognized before the dawn of tradition. We know of no era when movements due to terrestrial gravitation were attributed to volition. Only when the relation is obscured—only, as in the case of an aërolite, where the antecedent of the descent is unperceived, do we find the conception of personal agency. On the other hand, motions of intrinsically the same order as that of a falling stone —those of the heavenly bodies—long remain ungeneralized; and until their uniformity is seen, are construed as results of will. This difference is clearly not dependent on comparative complexity or abstractness; since the motion of a planet in an ellipse, is as simple and concrete a phenomenon as the motion of a projected arrow in a parabola. But the antecedents are not conspicuous; the sequences are of long duration; and they are not often repeated. And that these are the causes of their slow reduction to law, we see in the fact that they are severally generalized in the order of their frequency and conspicuousness—the moon's monthly cycle, the sun's annual change, the periods of the inferior planets, the periods of the superior planets.

While astronomical sequences were still ascribed to volition, certain terrestrial sequences of a different kind, but some of them equally without complication, were interpreted in like manner. The solidification of water at a low tempe-

rature, is a phenomenon that is simple, concrete, and of much personal concern. But it is neither so frequent as those which we see are earliest generalized, nor is the presence of the antecedent so manifest. Though in all but tropical climates, mid-winter displays the relation between cold and freezing with tolerable constancy; yet, during the spring and autumn, the occasional appearance of ice in the mornings has no very obvious connexion with coldness of the weather. Sensation being so inaccurate a measure, it is not possible for the savage to experience the definite relation between a temperature of 32° and the congealing of water; and hence the long continued belief in personal agency. Similarly, but still more clearly, with the winds. The absence of regularity and the inconspicuousness of the antecedents, allowed the mythological explanation to survive for a great period.

During the era in which the uniformity of many quite simple inorganic relations was still unrecognized, certain organic relations, intrinsically very complex and special, were generalized. The constant coexistence of feathers and a beak, of four legs with an internal bony framework, are facts which were, and are, familiar to every savage. Did a savage find a bird with teeth, or a mammal clothed with feathers, he would be as much surprised as an instructed naturalist. Now these uniformities of organic structure thus early perceived, are of exactly the same kind as those more numerous ones later established by biology. The constant coexistence of mammary glands with two occipital condyles to the skull, of vertebræ with teeth lodged in sockets, of frontal horns with the habit of rumination, are generalizations as purely empirical as those known to the aboriginal hunter. The botanist cannot in the least understand the complex relation between papilionaceous flowers and seeds borne in flattened pods: he knows these and like connexions simply in the same way that the barbarian knows the con-

nexions between particular leaves and particular kinds of wood. But the fact that sundry of the uniform relations which chiefly make up the organic sciences, were very early recognized, is due to the high degree of vividness and frequency with which they were presented to consciousness. Though the connexion between the sounds characteristic of a bird, and the possession of edible flesh, is extremely involved; yet the two terms of the relation are conspicuous, often recur in experience, and a knowledge of their connexion has a direct bearing on personal welfare. Meanwhile innumerable relations of the same order, which are displayed with even greater frequency by surrounding plants and animals, remain for thousands of years unrecognised, if they are unobtrusive or of no apparent moment.

When, passing from this primitive stage to a more advanced stage, we trace the discovery of those less familiar uniformities which mainly constitute what is distinguished as Science, we find the succession in which knowledge of them is reached, to be still determined in the same manner. This will become obvious on contemplating separately the influence of each derivative condition.

How relations that have immediate bearings on the maintenance of life, are, other things equal, fixed in the mind before those which have no immediate bearings, the history of Science abundantly illustrates. The habits of existing uncivilized races, who fix times by moons and barter so many of one article for so many of another, show us that conceptions of equality and number, which are the germs of mathematical science, were developed under the immediate pressure of personal wants; and it can scarcely be doubted that those laws of numerical relations which are embodied in the rules of arithmetic, were first brought to light through the practice of mercantile exchange. Similarly with geometry. The derivation of the word shows us that it ori-

ginally included only certain methods of partitioning ground and laying out buildings. The properties of the scales and the lever, involving the first principle in mechanics, were early generalized under the stimulus of commercial and architectural needs. To fix the times of religious festivals and agricultural operations, were the motives which led to the establishment of the simpler astronomic periods. Such small knowledge of chemical relations as was involved in ancient metallurgy, was manifestly obtained in seeking how to improve tools and weapons. In the alchemy of later times, we see how greatly an intense hope of private benefit contributed to the disclosure of a certain class of uniformities. Nor is our own age barren of illustrations. "Here," says Humboldt, when in Guiana, "as in many parts in Europe, the sciences are thought worthy to occupy the mind, only so far as they confer some immediate and practical benefit on society." "How is it possible to believe," said a missionary to him, "that you have left your country to come to be devoured by mosquitoes on this river, and to measure lands that are not your own." Our coasts furnish like instances. Every sea-side naturalist knows how great is the contempt with which fishermen regard the collection of objects for the microscope or aquarium. Their incredulity as to the possible value of such things is so great, that they can scarcely be induced even by bribes to preserve the refuse of their nets. Nay, we need not go for evidence beyond daily table-talk. The demand for "practical science"—for a knowledge that can be brought to bear on the business of life—joined to the ridicule commonly vented on scientific pursuits having no obvious uses, suffice to show that the order in which laws are discovered greatly depends on the directness with which they affect our welfare.

That, when all other conditions are the same, obtrusive relations will be generalized before unobtrusive ones, is so nearly a truism that examples appear almost superfluous. If

it be admitted that by the aboriginal man, as by the child, the co-existent properties of large surrounding objects are noticed before those of minute objects, and that the external relations which bodies present are generalized before their internal relations, it must be admitted that in subsequent stages of progress, the comparative conspicuousness of relations has greatly affected the order in which they were recognized as uniform. Hence it happened that after the establishment of those very manifest sequences constituting a lunation, and those less manifest ones marking a year, and those still less manifest ones marking the planetary periods, astronomy occupied itself with such inconspicuous sequences as those displayed in the repeating cycle of lunar eclipses, and those which suggested the theory of epicycles and eccentrics; while modern astronomy deals with still more inconspicuous sequences, some of which, as the planetary rotations, are nevertheless the simplest which the heavens present. In physics, the early use of canoes implied an empirical knowledge of certain hydrostatic relations that are intrinsically more complex than sundry static relations not empirically known; but these hydrostatic relations were thrust upon observation. Or, if we compare the solution of the problem of specific gravity by Archimedes with the discovery of atmospheric pressure by Torricelli (the two involving mechanical relations of exactly the same kind), we perceive that the much earlier occurrence of the first than the last was determined, neither by a difference in the irbearings on personal welfare, nor by a difference in the frequency with which illustrations of them came under observation, nor by relative simplicity; but by the greater obtrusiveness of the connexion between antecedent and consequent in the one case than in the other. Among miscellaneous illustrations, it may be pointed out that the connexions between lightning and thunder, and between rain and clouds, were recognized long before others of the same order, simply because they

thrust themselves on the attention. Or the long-delayed discovery of the microscopic forms of life, with all the phenomena they present, may be named as very clearly showing how certain groups of relations not ordinarily perceptible, though in other respects like long-familiar relations, have to wait until changed conditions render them perceptible. But, without further details, it needs only to consider the inquiries which now occupy the electrician, the chemist, the physiologist, to see that science has advanced, and is advancing, from the more conspicuous phenomena to the less conspicuous ones.

How the degree of absolute frequency of a relation affects the recognition of its uniformity, we see in contrasting certain biological facts. The connexion between death and bodily injury, constantly displayed not only in men but in all inferior creatures, was known as an instance of natural causation while yet deaths from diseases were thought supernatural. Among diseases themselves, it is observable that unusual ones were regarded as of demoniacal origin during ages when the more frequent were ascribed to ordinary causes: a truth paralleled among our own peasantry, who by the use of charms show a lingering superstition with respect to rare disorders, which they do not show with respect to common ones, such as colds. Passing to physical illustrations, we may note that within the historic period whirlpools were accounted for by the agency of water-spirits; but we do not find that within the same period the disappearance of water on exposure either to the sun or to artificial heat was interpreted in an analogous way: though a more marvellous occurrence, and a much more complex one, its great frequency led to the early recognition of it as a natural uniformity. Rainbows and comets do not differ much in conspicuousness, and a rainbow is intrinsically the more involved phenomenon; but chiefly because of their far greater commonness, rainbows were perceived to have a direct dependence

on sun and rain while yet comets were regarded as signs of divine wrath.

That races living inland must long have remained ignorant of the daily and monthly sequences of the tides, and that tropical races could not early have comprehended the phenomena of northern winters, are extreme illustrations of the influence which relative frequency has on the recognition of uniformities. Animals which, where they are indigenous, call forth no surprise by their structures or habits, because these are so familiar, when taken to countries where they have never been seen, are looked at with an astonishment approaching to awe—are even thought supernatural: a fact which will suggest numerous others that show how the localization of phenomena in part controls the order in which they are reduced to law. Not only however does their localization in space affect the progression, but also their localization in time. Facts which are rarely if ever manifested in one era, are rendered very frequent in another, simply through the changes wrought by civilization. The lever, of which the properties are illustrated in the use of sticks and weapons, is vaguely understood by every savage—on applying it in a certain way he rightly anticipates certain effects; but the wheel-and-axle, pulley, and screw, cannot have their powers either empirically or rationally known till the advance of the arts has more or less familiarized them. Through those various means of exploration which we have inherited and added to, we have become acquainted with a vast range of chemical relations that were relatively non-existent to the primitive man. To highly-developed industries we owe both the substances and the appliances that have disclosed to us countless uniformities which our ancestors had no opportunity of seeing. These and like instances that will occur to the reader, show that the accumulated materials, and processes, and products, which characterize the environments of complex societies, greatly increase the accessibility of various

classes of relations; and by so multiplying the experiences of them, or making them relatively frequent, facilitate their generalization. Moreover, various classes of phenomena presented by society itself, as for instance those which political economy formulates, become relatively frequent, and therefore recognizable, in advanced social states; while in less advanced ones they are either too rarely displayed to have their relations perceived, or, as in the least advanced ones, are not displayed at all.

That, where no other circumstances interfere, the order in which different uniformities are established varies as their complexity, is manifest. The geometry of straight lines was understood before the geometry of curved lines; the properties of the circle before the properties of the ellipse, parabola, and hyperbola; and the equations of curves of single curvature were ascertained before those of curves of double curvature. Plane trigonometry comes in order of time and simplicity before spherical trigonometry; and the mensuration of plane surfaces and solids before the mensuration of curved surfaces and solids. Similarly with mechanics: the laws of simple motion were generalized before those of compound motion; and those of rectilinear motion before those of curvilinear motion. The properties of equal-armed levers or scales, were understood before those of levers with unequal arms; and the law of the inclined plane was formulated earlier than that of the screw, which involves it. In chemistry, the progress has been from the simple inorganic compounds to the more involved or organic compounds. And where, as in the higher sciences, the conditions of the exploration are more complicated, we still may clearly trace relative complexity as determining the order of discovery where other things are equal.

The progression from concrete relations to abstract ones, and from the less abstract to the more abstract, is equally obvious. Numeration, which in its primary form concerned

itself only with groups of actual objects, came earlier than simple arithmetic; the rules of which deal with numbers apart from objects. Arithmetic, limited in its sphere to concrete numerical relations, is alike earlier and less abstract than Algebra, which deals with the relations of these relations. And in like manner, the Calculus of Operations comes after Algebra, both in order of evolution and in order of abstractness. In Mechanics, the more concrete relations of forces exhibited in the lever, inclined plane, etc., were understood before the more abstract relations expressed in the laws of resolution and composition of forces; and later than the three abstract laws of motion as formulated by Newton came the still more abstract law of inertia. Similarly with Physics and Chemistry, there has been an advance from truths entangled in all the specialities of particular facts and particular classes of facts, to truths disentangled from the disguising incidents under which they are manifested—to truths of a higher abstractness.

Brief and rude as is this sketch of a mental development that has been long and complicated, I venture to think it shows inductively what was deductively inferred, that the order in which separate groups of uniformities are recognized, depends not on one circumstance but on several circumstances. The various classes of relations are generalized in a certain succession, not solely because of one particular kind of difference in their natures; but also because they are variously placed in time and in space, variously open to observation, and variously related to our own constitutions: our perception of them being influenced by all these conditions in endless combinations. The comparative degrees of importance, of obtrusiveness, of absolute frequency, of relative frequency, of simplicity, of concreteness, are every one of them factors; and from their unions in proportions that are never twice alike, there results a highly complex process of mental evolution. But while it is thus manifest

that the proximate causes of the succession in which relations are reduced to law, are numerous and involved; it is also manifest that there is one ultimate cause to which these proximate causes are subordinate. As the several circumstances that determine the early or late recognition of uniformities are circumstances that determine the number and strength of the impressions which these uniformities make on the mind, it follows that the progression conforms to a certain fundamental principle of psychology. We see *à posteriori*, what we concluded *à priori*, that the order in which relations are generalized, depends on the frequency and impressiveness with which they are repeated in conscious experience.

Having roughly analyzed the progress of the past, let us take advantage of the light thus thrown on the present, and consider what is implied respecting the future.

Note first that the likelihood of the universality of Law has been ever growing greater. Out of the countless coexistences and sequences with which mankind are environed, they have been continually transferring some from the group whose order was supposed to be arbitrary, to the group whose order is known to be uniform. And manifestly, as fast as the relations that are unreduced to law become fewer, the probability that among them there are some that do not conform to law, becomes less. To put the argument numerically—It is clear that when out of surrounding phenomena a hundred of several kinds have been found to occur in constant connexions, there arises a slight presumption that all phenomena occur in constant connexions. When uniformity has been established in a thousand cases, more varied in their kinds, the presumption gains strength. And when the known cases of uniformity amount to myriads, including many of each variety, it becomes an ordinary induction that uniformity exists everywhere.

Silently and insensibly their experiences have been pressing men on towards the conclusion thus drawn. Not out of a conscious regard for these reasons, but from a habit of thought which these reasons formulate and justify, all minds have been advancing towards a belief in the constancy of surrounding coexistences and sequences. Familiarity with concrete uniformities has generated the abstract conception of uniformity—the idea of *Law;* and this idea has been in successive generations slowly gaining fixity and clearness. Especially has it been thus among those whose knowledge of natural phenomena is the most extensive—men of science. The mathematician, the physicist, the astronomer, the chemist, severally acquainted with the vast accumulations of uniformities established by their predecessors, and themselves daily adding new ones as well as verifying the old, acquire a far stronger faith in law than is ordinarily possessed. With them this faith, ceasing to be merely passive, becomes an active stimulus to inquiry. Wherever there exist phenomena of which the dependence is not yet ascertained, these most cultivated intellects, impelled by the conviction that here too there is some invariable connexion, proceed to observe, compare, and experiment; and when they discover the law to which the phenomena conform, as they eventually do, their general belief in the universality of law is further strengthened. So overwhelming is the evidence, and such the effect of this discipline, that to the advanced student of nature, the proposition that there are lawless phenomena has become not only incredible but almost inconceivable.

This habitual recognition of law which already distinguishes modern thought from ancient thought, must spread among men at large. The fulfilment of predictions made possible by every new step, and the further command gained of nature's forces, prove to the uninitiated the validity of scientific generalizations and the doctrine they illustrate. Widening education is daily diffusing among the mass of

men that knowledge of these generalizations which has been hitherto confined to the few. And as fast as this diffusion goes on, must the belief of the scientific become the belief of the world at large.

That law is universal, will become an irresistible conclusion when it is perceived that *the progress in the discovery of laws itself conforms to law;* and when this perception makes it clear why certain groups of phenomena have been reduced to law, while other groups are still unreduced. When it is seen that the order in which uniformities are recognized, must depend upon the frequency and vividness with which they are repeated in conscious experience; when it is seen that, as a matter of fact, the most common, important, conspicuous, concrete, and simple, uniformities were the earliest recognized, because they were experienced oftenest and most distinctly; it will by implication be seen that long after the great mass of phenomena have been generalized, there must remain phenomena which, from their rareness, or unobtrusiveness, or seeming unimportance, or complexity, or abstractness, are still ungeneralized. Thus will be furnished a solution to a difficulty sometimes raised. When it is asked why the universality of law is not already fully established, there will be the answer that the directions in which it is not yet established are those in which its establishment must necessarily be latest. That state of things which is inferable beforehand, is just the state which we find to exist. If such coexistences and sequences as those of Biology and Sociology are not yet reduced to law, the presumption is not that they are irreducible to law, but that their laws elude our present means of analysis. Having long ago proved uniformity throughout all the lower classes of relations, and having been step by step proving uniformity throughout classes of relations successively higher and higher, if we have not yet succeeded with the highest classes, it may

be fairly concluded that our powers are at fault, rather than that the uniformity does not exist. And unless we make the absurd assumption that the process of generalization, now going on with unexampled rapidity, has reached its limit, and will suddenly cease, we must infer that ultimately mankind will discover a constant order of manifestation even in the most involved and obscure phenomena.

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