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ENGLISH POSITIVISM.

A STUDY

ON

JOHN STUART MILL.

By H. TAINE.

Translated from the French

(WITH THE AUTHOR'S PERMISSION),

By T. D. HAYE.

SECOND EDITION.

WILLIAMS AND NORGATE,
14, HENRIETTA STREET, COVENT GARDEN, LONDON;
AND 20, SOUTH FREDERICK STREET, EDINBURGH.
1873.

TABLE OF CONTENTS.

PART II.

*** The References are to the Fourth Edition of "MILL'S LOGIC."

PREFACE.

When this Study first appeared, Mr. Mill did me the honour to write to me that it would not be possible to give in a few pages a more exact and complete notion of the contents of his work, considered as a body of philosophical teaching. "But," he added, "I think you are wrong in regarding the views I adopt as especially English. They were so in the first half of the eighteenth century, from the time of Locke to that of the reaction against Hume. This reaction, beginning in Scotland, assumed long ago the German form, and ended by prevailing universally. When I wrote my book I stood almost alone in my opinions, and though they have met with a degree of sympathy which I by no means expected, we may still count in England twenty *à*

priori and spiritualist philosophers for every partisan of the doctrine of Experience."

This remark is very true. I myself could have made it, having been brought up in the doctrines of Scotch philosophy, and the writings of Reid. I simply answer that there are philosophers whom we do not count, and that all such, whether English or not, spiritualist or not, may be neglected without much harm. Once in a half century, or perhaps in a century, or two centuries, some thinker appears; Bacon and Hume in England, Descartes and Condillac in France, Kant and Hegel in Germany. At other times the stage is unoccupied, or ordinary men come forward, and offer the public that which the public likes—Sensualists or Idealists, according to the tendency of the day, with sufficient instruction and skill to play leading parts, and enough capacity to re-set old airs, well drilled in the works of their predecessors, but destitute of real invention—simple executant musicians, who stand in the place of composers. In Europe, at present, the stage is a blank.

The Germans adapt and alter effete French materialism. The French listen from habit, but somewhat wearily and distractedly, to the scraps of melody and eloquent commonplace which their instructors have repeated to them for the last thirty years. In this deep silence, and from among these dull mediocrities, a master comes forward to speak. Nothing of the sort has been seen since Hegel.

A STUDY ON MILL.

I.

When at Oxford the other year during the meeting of the British Association, I met among the few students still in residence a young Englishman, a man of ability, with whom I became intimate. In the evenings we went to the New Museum, which was well filled with specimens. Short lectures were delivered there, and models of machinery were set to work; ladies were present, and watched the proceedings with interest, and at their close, on the last evening, "God save the Queen' was sung. I admired this zeal, this solidity of mind, this organization of science, these voluntary subscriptions, this aptitude for association and for labour, this great machine pushed

on by so many arms, and so well fitted to accumulate, criticise, and classify facts. But yet, amidst this abundance, there was a dearth: when I read the Transactions, I imagined myself assisting at a congress of heads of manufactories. All these learned men were engaged in verifying details and exchanging recipes. I seemed to hear foremen telling one another their processes for tanning leather or dyeing cotton. There was a lack of general ideas. I used to lament this to my friend, and at night, by his lamp, we discussed its reasons, while the university city lay wrapped in silence below.

II.

One day, I said to him: "You are wanting in philosophy; I mean in what Germans call metaphysics. You have learned men; but you have no thinkers. Your God impedes you; for out of respect to Him, (your Supreme Cause) you do not venture to reason on causes. He is far the most important personage in England, and I see how He merits His position; not only as forming a part of your constitution, but as the guardian of your morality, the judge in final appeal on all questions whatsoever, and an advantageous substitute for the prefects and gendarmes with whom continental nations are still encumbered. Nevertheless, the rank you accord Him has the inconvenience of all official positions—it produces a cant, prejudice, intolerance, and courtiers. Close by you have poor Mr. Max Müller, who, in order to acclimatise here the

study of Sanscrit, was forced to discover in the Vedas the worship of a moral god—that is to say, the religion of Paley and Addison. A few days ago, in London, I read a Queen's proclamation forbidding people to play cards, even at home, on Sundays. It seems that, if I were robbed, I should not be able to bring the thief to justice without first taking a religious oath, and, if I refused, the judge would send me away, deny me justice, and insult me into the bargain. Every year, when we read in your papers the speech from the throne, we find there the inevitable mention of Divine Providence, which comes in mechanically, like the apostrophe to the immortal gods in the fourth page of a rhetorical declamation; and once, as you know, when the pious sentence was omitted, a second communication was made to Parliament for the express purpose of supplying it. All this formality and pedantry indicates to my mind a celestial monarchy, and naturally it resembles all others: I mean that it rests more willingly on tradition and custom

than on examination and reason. Never did monarchy invite men to verify its credentials. As, however, yours is useful, moral, and well adapted to you, you are not revolted by it, but submit to it without difficulty ; at heart you are attached to it, and would fear, in touching it, to upset the constitution and morality. You ascribe this dominion to the Most High amidst public homage ; you turn away and bring yourselves down to matters of fact, to minute dissections, to the operations of the laboratory. You betake yourselves to culling plants and collecting shells. Science is deprived of its head and crown. But all is for the best, for practical life is benefited, and dogma is preserved intact."

III.

"You are truly French," said he; "you stride over the facts, and with one bound you are settled in a theory. You must know that we do possess thinkers, and need not go far from here to find them—at Christ Church, for example. One of them, the professor of Greek, has spoken so profoundly on inspiration, the creation, and final causes, as to have incurred persecution. Look at this little collection which has recently appeared—*Essays and Reviews.* Your philosophic freedoms of the last century, the latest conclusions of geology and cosmogony, the intrepidities of German exegesis, are here in abridgment. Some things you will not find—the buffoonery of Voltaire, the misty jargon of Germany, and the prosaic coarseness of Comte. To my mind the loss is small. Wait twenty years, and you will find in London the ideas of

Paris and Berlin."—"But they will still be the ideas of Paris and Berlin. Whom have you original?"—"Stuart Mill."—"Who then is he?"—"A political writer. His little book *On Liberty* is as admirable as the *Social Contract* is abominable."—"That is a bold assertion."—"Not so; for Mill decides as strongly for the liberty of the individual, as Rousseau for the despotism of the state."—"Very well; but that is not enough to make up a philosopher. What more is he?"—"An economist, who raises himself above his science, and subordinates production to man, not man to production."—"Well; but even that is not enough to make up a philosopher. Is he anything else?"—"A logician."—"Well; but of what school?"—"Of his own. I told you he was original."—"Is he Hegelian?"—"Not at all. He is too fond of facts and proofs."—"Is he a follower of Port Royal?"—"Still less. He is too well acquainted with modern science."—"Is he an imitator of Condillac?"—"No, indeed. Condillac has merely taught him to write well."—"Who then are his allies?"—"Locke and

Comte in the first rank; then Hume and Newton."—"Is he a system-monger?—a speculative reformer?"—"He has too much sense for that. All he does is to construct the best theories, and lay down the best practical rules. He does not attitudinize majestically in the character of a reformer of science; he does not declare, like your Germans, that his book is destined to inaugurate a new era for the human race. He proceeds step by step, slowly, and often creepingly, over a multitude of particular facts. He excels in giving precision to an idea; in disentangling a principle; in tracing it through a number of different facts; in refuting, in distinguishing, in reasoning. He has the astuteness, the patience, the method, and the sagacity of a lawyer."—"Very well. You admit I was right. A lawyer; an ally of Locke, of Newton, of Comte, and of Hume; all we have here is the English philosophy. But no matter. Has he attained a great conception of the universe?"—"Yes."—"Has he a complete personal idea of nature and of the mind?"—"Yes."—"Has he arranged the

operations and discoveries of the intellect under a single principle which puts them all in a new light?"—"Yes. But this principle has to be discovered."—"That is for you to do, and I hope you will undertake it."—"But we shall fall into abstract generalities."—"There is no harm in that."—"But this close reasoning will be like a quick-set hedge."—"We will prick our fingers with it."—"But three men out of four cast aside such speculations as idle."—"So much the worse for them. For in what does the life of a nation or an age consist except in the formation of such theories? Man is but thoroughly man when so engaged. If some inhabitant of another planet were to descend here to ask us the nature of our race, it would be necessary to show him the five or six great ideas which we have formed of the mind and of the universe. That alone would give him the measure of our intelligence. Explain to me your theory, and I shall go away better instructed than from having seen the masses of brick you call London and Manchester!"

§ I.

EXPERIENCE.

I.

Let us begin then, like logicians, at the beginning. Mill has written on Logic. What is Logic? It is a science, and has for its subject all other sciences, for if we have traversed the universe, and know every part of it—stars, earth, sun, heat, gravity, chemical affinities, the species of minerals, geological changes, plants, animals, human events, and all that classifications and theories embrace and explain, there still remain these classifications and these theories to be learnt. Not only have we an order of beings, but also an order of the thoughts which represent them; not only plants and animals, but also botany and

zoology; not only lines, surfaces, volumes, and numbers, but also geometry and arithmetic. Sciences, then, are things as real as facts themselves, and therefore as capable as facts of becoming the subject of study. We can analyse them as we analyse facts; we can investigate their elements, their composition, their order, their relations, and their object. There is, therefore, a science of sciences, and this it is which we call logic, and which forms the subject of Mill's work. It is no part of logic to analyse the operations of the mind, memory, association of ideas, external perception, &c., which belongs to psychology; or to discuss the value of such operations, the veracity of our consciousness, the certainty of our elementary knowledge, which belongs to metaphysics; but we assume our faculties to be at work, and admit their primary discoveries. We take the instrument as nature furnishes it, and trust to its accuracy. We leave to others the task of taking its mechanism to pieces, and the curiosity which criticises its results. Setting out from its primitive

operations, we enquire how they aid each other, how they combine together, how one is convertible into another, how, by additions, combinations, and conversions, they finally make up a growing system of connected truths. We construct a theory of science, as others construct theories of vegetation, of the mind, or of numbers. Such is the idea of logic; and it is plain that it has, as other sciences, a real subject-matter, its distinct province, an evident importance, its proper method, and a certain future.

II.

This being premised, we observe that all these sciences which form the subject of logic are nothing more than collections of propositions; and all that each proposition does is to connect or separate a subject and an attribute—that is to say, a name and another name; a quality and a substance—that is to say, a thing and another thing. We must consider, then, what it is we understand by a thing, and what it is we indicate by a name; in other words, what it is we know in objects, what it is we connect or separate, what it is that forms the matter of all our propositions and all our science. There is a point in which all our several items of knowledge resemble one another. There is a common element which, by continued repetition, makes up all our

ideas. There is, as it were, a little primitive crystal which, indefinitely and diversely added to itself, forms the total mass, and which once known, teaches us beforehand the laws and the composition of the complex bodies which it has formed.

Now, when we consider attentively the idea we form of a thing, what do we find in it? To commence with Substances—that is to say, Bodies and Minds.* This table is

* It is certain, then, that a part of our notion of a body consists of the notion of a number of sensations of our own, or of other sentient beings, habitually occurring simultaneously. My conception of the table at which I am writing is compounded of its visible form and size, which are complex sensations of sight; its tangible form and size, which are complex sensations of our organs of touch and of our muscles; its weight, which is also a sensation of touch and of the muscles; its colour, which is a sensation of sight; its hardness, which is a sensation of the muscles; its composition, which is another word for all the varieties of sensation which we receive, under various circumstances from the wood of which it is made; and so forth. All or most of these various sensations frequently are, and, as we learn by experience, always might be, experienced simultaneously, or in many different orders of succession, at our own choice: and hence the thought of any one of them makes us think

brown, and judging by the eye, it is three feet in length, breadth, and height; which means that it forms a little spot in the field of vision; or, in other words, that it produces a certain sensation on the optic nerve. It weighs ten pounds; which means, that to lift it requires less effort than a weight of eleven and greater than a weight of nine pounds; or, in other words, that it produces a certain muscular sensation. It is hard and square; which again means that if first pressed and then run over by the hand, it will give rise to two different kinds of muscular sensation; and so forth. On closely examining what I know of it, I find nothing, except the impressions it makes on me. Our idea of a body comprises nothing more than this: we know nothing of it but the sensations it excites in us; we determine it by the nature, number, and order of these sensations; we are ignorant of its inner

of the others, and the whole becomes mentally amalgamated into one mixed state of consciousness, which, in the language of Locke and Hartley, is termed a Complex Idea.—Vol. i., p. 62.

nature, if such there be; we affirm simply that it is the unknown cause of these sensations. When we say that a body has existed in the absence of our sensations, all we mean is, that if we had been within range of it during the time in question, we should have had sensations which we have not had. We define it only by means of our impressions, present or past, future or possible, complex or simple. This is so true that philosophers like Berkeley have maintained with some show of truth that matter is a creature of the imagination, and that the whole world of sense is reducible to an order of sensations. However this may be, it is so, as far as our knowledge is concerned; and the judgments which make up our sciences, refer merely to the impressions by which things are manifested to us.

So again with the mind. We may readily admit that there is in us a soul, an "ego," a subject or recipient of our sensations and other modes of being, and distinct from those sensations and modes of being, but of it we know nothing. All that we are aware

of, says Mill,* even in our own minds, is a certain thread of consciousness, a series of feelings—that is, of sensations, thoughts, emotions, and volitions, more or less numerous and complicated. We have no clearer notion of mind than of matter, and can affirm no more of it than of matter. So that substances, of whatever kind, bodies or minds, within us or without us, are never

* For, as our conception of a body is that of an unknown exciting cause of sensations, so our conception of a mind is that of an unknown recipient, or percipient, of them; and not of them alone, but of all our other feelings. As body is the mysterious something which excites the mind to feel, so mind is the mysterious something which feels, and thinks. It is unnecessary to give in the case of mind, as we gave in the case of matter, a particular statement of the sceptical system by which its existence as a Thing in itself, distinct from the series of what are denominated its states, is called in question. But it is necessary to remark, that on the inmost nature of the thinking principle, as well as on the inmost nature of matter, we are, and with our faculties must always remain, entirely in the dark. All which we are aware of, even in our own minds, is (in the words of Mr. Mill) a certain "thread of consciousness;" a series of feelings, that is, of sensations, thoughts, emotions, and volitions, more or less numerous and complicated.—Vol. i., p. 68.

more to us than tissues, more or less complex, more or less regular, of which our feelings and modes of being form all the threads.

This is even clearer in the case of attributes than of substances. We say that snow is white, meaning that when in sight of snow we have the sensation of whiteness. We say that fire is hot, meaning that when near the fire we have the sensation of heat. We call a mind devout, superstitious, meditative, or gay, simply meaning that the ideas, the emotions, the volitions, designated by these words, recur frequently in the series of its modes of being.*

* Every attribute of mind consists either in being itself affected in a certain way, or affecting other minds in a certain way. Considered in itself, we can predicate nothing of it but the series of its own feelings. When we say of any mind, that it is devout, or superstitious, or meditative, or cheerful, we mean that the ideas, emotions, or volitions, implied in those words, form a frequently recurring part of the series of feelings, or states of consciousness, which fill up the sentient existence of that mind.

In addition, however, to those attributes of a mind which are grounded on its own states of feeling, attributes may also be ascribed to it, in the same manner

Again, we call bodies heavy, divisible, moveable, &c., meaning that when let go they will fall, when cut they will separate, when pushed they will move,—in other words, that under such and such circum-

as to a body, grounded on the feelings which it excites in other minds. A mind does not, indeed, like a body, excite sensations, but it may excite thoughts or emotions. The most important example of attributes ascribed on this ground, is the employment of terms expressive of approbation or blame. When, for example, we say of any character, or (in other words) of any mind, that it is admirable, we mean that the contemplation of it excites the sentiment of admiration; and, indeed somewhat more, for the word implies that we not only feel admiration, but approve that sentiment in ourselves. In some cases, under the semblance of a single attribute, two are really predicated: one of them, a state of the mind itself; the other, a state with which other minds are affected by thinking of it. As when we say of any one that he is generous. The word generosity expresses a certain state of mind, but being a term of praise, it also expresses that this state of mind excites in us another mental state, called approbation. The assertion made, therefore, is twofold, and of the following purport: Certain feelings form habitually a part of this person's sentient existence: and the idea of those feelings of his, excites the sentiment of approbation in ourselves or others.—Vol. i., p. 80.

stances they will produce such and such feelings in our muscles, or our sight. An attribute invariably marks some one, or some series of our modes of being. In vain do we disguise these modes of being, by hiding them under abstract names, by grouping, dividing, and transforming them, till we can sometimes scarcely recognise them. We still find them, and find nothing but them, whenever we examine our words and ideas with sufficient minuteness. Analyse, says Mill, an abstract proposition—for example, a generous person is worthy of honour.* The word generous denotes

* Take the following example: A generous person is worthy of honour. Who would expect to recognise here a case of co-existence between phenomena? But so it is. The attribute which causes a person to be termed generous, is ascribed to him on the ground of states of his mind, and particulars of his conduct: both are phenomena; the former are facts of internal consciousness, the latter, so far as distinct from the former, are physical facts, or perceptions of the senses. Worthy of honour, admits a similar analysis. Honour, as here used, means a state of approving and admiring emotion, followed on occasion by corresponding outward acts. "Worthy of honour" connotes all this, together with

certain habitual states of mind and certain habitual particularities of conduct—that is to say, internal modes of being and external sensible facts. The word honour expresses a sentiment of approbation and admiration, followed on occasion by corresponding outward acts. The word worthy indicates that we approve of the act of showing honour. All these are phenomena or states of mind followed or accompanied by physical facts. We may turn about then as we please, but shall still find ourselves in the same circle. Whether the object of thought be attribute or substance, concrete or abstract, compound or simple, its material is to us the same—it

an approval of the act of showing honour. All these are phenomena; states of internal consciousness, accompanied or followed by physical facts. When we say, A generous person is worthy of honour, we affirm coexistence between the two complicated phenomena connoted by the two terms respectively. We affirm that wherever and whenever the inward feelings and outward facts implied in the word generosity have place, then and there the existence and manifestation of an inward feeling, honour, would be followed in our minds by another inward feeling, approval.—Vol. i., p. 110.

is made up of our modes of being only. Our mind is to nature what a thermometer is to a boiler: we define the properties of nature by the feelings of our mind as we indicate states of heat by the variations of the thermometer. We know nothing of one or of the other but states and changes; we make up the one and the other of isolated and transient facts; a thing is nothing more to us than a collection of phenomena. These are the only elements of our knowledge; and in every case every effort of science must be the addition or connection of fact to fact.

III.

This little phrase sums up the whole system. Familiarise yourself with it, for it explains all Mill's theories. His definitions and his innovations commence alike from this starting-point. In all forms and degrees of knowledge, he has recognised the knowledge only of facts, and of their relations.

Now logic, as you know, has two corner-stones, the Theories of Definition and of Proof. Since the days of Aristotle, logicians have passed their time in polishing them. They have only dared to touch them respectfully, as if they were holy. The utmost that any innovator has occasionally ventured on, has been to turn them carefully in order to put them in a better light. Mill overturns, cuts, pares away, and replaces them both in a similar manner, and by the same means.

IV.

I AM quite aware that people are laughed at now-a-days for reasoning on definitions; but you, I hope, are not guilty of this absurdity. No theory is more fruitful in universal and important consequences; it is the root by which the tree of science grows and lives. For in defining things we mark out their nature. To introduce a new idea of definition is to introduce a new idea of the nature of things, of what beings are, of what they are composed, and of the elements into which they are capable of being resolved. In this lies the merit of these dry speculations; the philosopher seems occupied with matters of mere convention, while, in fact, he is mapping out the universe.

Take, say logicians, an animal, a plant, a sentiment, a geometrical figure, an object

or a group of objects. No doubt the object has its properties, but it has also its essence. It manifests itself to the outer world by an indefinite number of effects and qualities; but all these modes of being are the consequences or the results of its inner nature. There is in it a certain hidden substratum which alone is primitive and important, without which it can neither exist nor be conceived, and which constitutes its being and our notion of it.* Definitions they consider to be propositions denoting this essence, and assert that such propositions constitute the most valuable part of our knowledge. Mill, on the contrary, holds that propositions of this kind teach us nothing; they acquaint us with the meaning of a word, and are simply verbal.†

* According to the idealist school of logicians, we discover this being by examining our notion of it; and the idea, on analysis, shows us the essence. According to the classifying school, we arrive at the being by placing the object in its group, and define the notion by stating the genus and the difference. Both agree that we are capable of arriving at the essence.

† An essential proposition, then, is one which is

What do I learn by being told that man is a reasonable animal, or that a triangle is a space contained by three lines? The first part of such a phrase expresses by an abbreviation what the second part expresses in a developed phrase. You tell me the same thing twice—you put the same fact into two different expressions—you do not add one fact to another, but a fact to its equivalent; your proposition is not instructive—you might collect a million such, and my mind would remain completely empty—I should have read a dictionary, but not have acquired a single piece of knowledge. They tell us that essential propositions are important, and those con-

purely verbal; which asserts of a thing under a particular name, only what is asserted of it in the fact of calling it by that name; and which therefore either gives no information, or gives it respecting the name, not the thing. Non-essential, or accidental propositions, on the contrary, may be called real propositions, in opposition to verbal. They predicate of a thing, some fact not involved in the signification of the name by which the proposition speaks of it; some attribute not connoted by that name.—Vol. i., p. 127.

cerning qualities merely accessory ; but the contrary is the truth, for propositions relating to qualities are the important ones, and the others merely accessory. I learn nothing by being told that a circle is a figure formed by the revolution of a straight line about one of its points as centre ; I learn a fact when told that the chords which subtend equal arcs of the circle are themselves equal, or that three given points are sufficient to determine the circumference. What we call the nature of a being is the connected system of facts which make up that being. The nature of a carnivorous mammal consists in the combination of the property of giving milk, and all its implied peculiarities of structure, with sharp teeth, with hunting instincts, and the corresponding faculties. Such are the elements which compose its nature. They are facts linked together as mesh to mesh in a net. Some of them we perceive, but we can also see that far beyond our present knowledge and future experience, the net extends to infinity its multiplied and

interlacing threads. The essence or nature of a being is the indefinite sum of its properties. "No definition," says Mill, "expresses this nature in all its entirety, and every proposition expresses some part of this nature."* Give up, then, the vain hope of eliminating from properties a primitive and mysterious being, the source and summary of the whole—leave entities to Duns Scotus; do not imagine that either the examination of your ideas in the German fashion, or the classification of objects according to genera and species in the manner of the schoolmen—that the revival of the nominal science of the Middle Ages, or the riddles of Hegelian metaphysics—will ever

* The definition, they say, unfolds the nature of the thing: but no definition can unfold its whole nature; and every proposition in which any quality whatever is predicated of the thing, unfolds some part of its nature. The true state of the case we take to be this. All definitions are of names, and of names only; but, in some definitions, it is clearly apparent, that nothing is intended except to explain the meaning of the word; while in others, besides explaining the meaning of the word, it is intended to be implied that there exists a thing, corresponding to the word.—Vol. i., p. 162.

enable you to dispense with experience. There are no definitions of things; what definitions there are define names only. No phrase can tell me what a horse is, but there are phrases which will inform me what is meant by these five letters. No phrase can exhaust the inexhaustible sum of the qualities which make up a being, but many phrases point out the facts which correspond to a word. Here definition is possible, for an analysis may always be made which will enable us to pass from the abstract and summary term to the attributes which it represents, and from these attributes to the feelings, whether internal, or of the senses which serve for their foundation. By it, we pass from the term *dog* to the attributes mammiferous, carnivorous, &c., which it represents; and from these to the sensations of sight, of the touch, of the scalpel on which they are founded. It reduces the compound to the simple, the derived to the primitive. It brings back our knowledge to its origin. It transforms words into facts. If some definitions, like those of geometry, seem

capable of giving rise to long sequences of new truth,* it is through their comprising the affirmation of a fact in addition to the explanation of a word. In the definition of a triangle there are two distinct propositions: the one stating that there may exist a figure bounded by three straight lines, the other that such a figure is called a triangle; the first is a postulate, the second a definition. The first is hidden, the second lies on the surface. The first may be true or false, the second is not susceptible of either truth or falsehood. The first is the source of all possible theorems as to triangles,

* The definition above given of a triangle, obviously comprises not one, but two propositions, perfectly distinguishable. The one is, "There may exist a figure, bounded by three straight lines:" the other, "And this figure may be termed a triangle." The former of these propositions is not a definition at all: the latter is a mere nominal definition, or explanation of the use and application of a term. The first is susceptible of truth or falsehood, and may therefore be made the foundation of a train of reasoning: the latter can neither be true nor false; the only character it is susceptible of is that of conformity to the ordinary usage of language.—Vol. i., p. 162.

the second does but resume in a word the facts contained in the other. The first is a truth, the second a convention ; the first a part of science, the second an expedient of language. The first expresses a possible relation between three straight lines, the second names this relation ; the first alone is fruitful, for it alone conforms to the nature of fruitful propositions and connects two facts. Let us, then, understand exactly the nature of our knowledge : it relates either to words, or to things, or to both at once. If it relates to words, as in definitions of names, it attempts to refer back from the words to our primitive feelings ; that is to say, to the facts which constitute their elements. If it relates to beings, as in propositions about things, it attempts to link fact to fact, to connect the finite number of known properties with the infinite number of properties to be known. If both are involved, as in the above-mentioned definition of names, which conceal (as it were) a proposition relating to a thing, it attempts to do both, but to do no

more. Its operation is everywhere the same. In every case it is either a matter of explanation—that is, of reverting to the facts; or of teaching—that is, of the connection of facts.

V.

The first rampart, then, is destroyed; I suppose you will await our philosopher behind the second—the Theory of Proof. This theory has for two thousand years passed for an acquired, definite, impregnable truth. Many have pronounced it useless, but no one has ventured to question its truth. It has been considered on all sides as an established theorem.

Well, let us examine it. What is a proof? According to logicians it is a syllogism, and a syllogism is a group of three propositions of this kind :—

All men are mortal;

Prince Albert is a man;

Therefore Prince Albert is mortal.

Here we have the type of a proof, and every complete proof is conformable to this

type. Now, what is there, according to logicians, in this proof? A general proposition concerning all men which gives rise to a particular proposition concerning a certain man. We pass from the first to the second, because the second is contained in the first; from the general to the particular, because the particular is comprised in the general. The second is but an instance of the first; its truth is contained beforehand in the truth of the first; and it is for this reason that it is a truth. In fact, when the conclusion is no longer contained in the premises, the reasoning is false; and all the complicated rules of the Middle Ages have been reduced by the Port Royalists to this single rule, "The conclusion must be contained in the premises." Thus the course of the human mind in its reasonings, consists in recognising in the individual that which is known of the class; in affirming in detail what has been established in general; in stating a second time, and instance by instance, that which has been stated once for all at first.

Not at all, says Mill, for if so, our reasoning is useless. It is not a progress, but a repetition. When I have affirmed that all men are mortal, I have thereby affirmed that Prince Albert is mortal. In speaking of the whole class—that is to say, of all the individuals of the class—I have spoken of each individual, and therefore of Prince Albert, who is one of them. I say nothing new, then, when I now speak expressly of him. My conclusion teaches me nothing; it adds nothing to my positive knowledge; it does but put in a new form a piece of knowledge which I already possessed; it is not fruitful, it is purely verbal. If, then, reasoning be what logicians represent it, reasoning is not instructive; I know as much of the subject before commencing my reasoning as after I have finished it. I have transformed words into other words; I have manœuvred without gaining ground. But this cannot be, for reasoning does, in fact, teach us new truths. I learn a new truth when I discover that Prince Albert is mortal, and I discover it by reasoning, for

since he is still alive I cannot have learnt it by direct observation. Thus logicians are wrong, and we must abandon this scholastic theory of the syllogism which reduces reasoning to substitutions of words, and seek for a positive theory of proof which will explain how it is that, by the process of reasoning, we discover facts. For this purpose, it is sufficient to observe that general propositions are not the true proof of particular propositions. They seem so, but are not. It is not from the mortality of all men that I conclude Prince Albert to be mortal—the premises are elsewhere, and in the background. The general proposition is but a memento, a sort of abbreviating register, to which I have consigned the results of my experience. This memento may be considered as a note-book to which we refer to refresh our memory; our knowledge does not come from the book, but from what we have seen. The whole value of our notes is derived from the facts they recall. My general proposition has no value except from the particular facts which

it sums up. "The mortality of John, Thomas, and Company is, after all, the whole evidence which we have for the mortality of Prince Albert." *—"The true reason which makes us believe that Prince Albert will die is, that his ancestors, and our ancestors, and all the other persons who were their contemporaries, are dead. These facts are the true premises of our reasoning." It is from them that we have gathered the general proposition; they have taught us its extent and its truth; its office is limited to mentioning them in a shorter form; it derives all its

* The mortality of John, Thomas, and Company is, after all, the whole evidence we have for the mortality of the Duke of Wellington. Not one iota is added to the proof by interpolating a general proposition. Since the individual cases are all the evidence we can possess, evidence which no logical form into which we choose to throw it can make greater than it is; and since that evidence is either sufficient in itself, or, if insufficient for the one purpose, cannot be sufficient for the other; I am unable to see why we should be forbidden to take the shortest cut from these sufficient premises to the conclusion, and constrained to travel the "high priori road" by the arbitrary fiat of logicians.—Vol. i., p. 211.

substance from them; they are acting through it and by it to lead us to the conclusion to which it apparently gives rise. It is but their representative, and on occasion they dispense with it. Children, ignorant persons, and animals know that the sun will rise, that water will drown them, that fire will burn them, without the aid of a general proposition. They reason, and we, too, frequently reason, not from the general to the particular, but from particular to particular. "The mind always passes from observed to unobserved cases, either with or without commemorative formulæ. We only employ them for convenience."* "If we had a sufficiently capacious

* All inference is from particulars to particulars: general propositions are merely registers of such inferences already made, and short formulæ for making more: the major premiss of a syllogism, consequently, is a formula of this description: and the conclusion is not an inference drawn *from* the formula, but an inference drawn *according* to the formula: the real logical antecedent, or premise, being the particular facts from which the general proposition was collected by induction. Those facts, and the individual instances which

memory, and the faculty of maintaining order among a huge mass of details, we should be able to reason without employing a single general proposition."* Here, as before, logicians have blundered; they have given the highest rank to verbal propositions, and left the really fruitful operations in the background. They have given precedence to words over facts. They have kept alive the nominal science of the Middle Ages. They have mistaken the explanation of names for the nature of things, and the

supplied them, may have been forgotten; but a record remains, not indeed descriptive of the facts themselves, but showing how those cases may be distinguished respecting which the facts, when known, were considered to warrant a given inference. According to the indications of this record we draw our conclusion; which is, to all intents and purposes, a conclusion from the forgotten facts. For this it is essential that we should read the record correctly: and the rules of the syllogism are a set of precautions to ensure our doing so.—Vol. i., p. 218.

* If we had sufficiently capacious memories, and a sufficient power of maintaining order among a huge mass of details, the reasoning could go on without any general propositions; they are mere formulæ for inferring particulars from particulars.—Vol. i., p. 240.

transformation of ideas for the progress of the mind. We must upset this in logic as we have upset it in science—we must exalt the particular and instructive facts, and give them that authority and importance in theory which our practice has conferred on them for the last three hundred years.

VI.

A PHILOSOPHICAL fortress remains in which Idealists shelter themselves. At the origin of all proof are Axioms, from which all proof is derived. Two straight lines cannot enclose a space; things which are equal to the same thing are equal to one another; if equals be added to equals the wholes are equal. These propositions are instructive, for they express, not meanings of words, but relations of things; and moreover, they are fruitful, for the sciences of arithmetic, algebra, and geometry are derived from their truth. On the other hand, they are not founded on experience, for we know that two straight lines cannot enclose a space from our mental conception of them without the necessity of actually following them with our eyes. For this purpose we do not

require the evidence of our senses,—our belief arises wholly and with full force from the simple comparison of our ideas. Besides, experience does not follow our two lines for more than a limited distance—for ten, twenty, or a thousand feet; and the axiom is true for a thousand, ten thousand, or a million miles, and for an unlimited distance. So that, beyond the point at which experience ceases, it cannot be experience that establishes the axiom. Finally, the axiom is a necessary truth—that is to say, its contrary is inconceivable. We cannot imagine a space enclosed by two straight lines; for as soon as we imagine a space to be enclosed, the two lines cease to be straight; and as soon as we imagine the two lines to be straight, the space ceases to be enclosed. In the assertion of axioms, the two constituent ideas are inevitably connected. In the negation of axioms, the two constituent ideas inevitably repel each other. Now this is not so with truths of experience; they state an accidental, not a necessary connection; they lay down the connection of

certain facts, not that they must be connected; they show us that bodies are heavy, not that they are necessarily heavy. Thus, axioms are not and cannot be the results of experience. They are not so, because we can form them mentally without the aid of experience; they cannot be so, because the nature and range of their truths lie without the limits of experimental truths. They have another and a deeper source. They spring elsewhere, and have a wider scope.

Not so, answers Mill. Here again you reason scholastically, and overlook the facts hidden behind your conceptions; for consider your first argument. No doubt you can discover, without employing your eyes, and by purely mental contemplation, that two straight lines cannot enclose a space, but this contemplation is but a displaced experiment in which imaginary lines take the place of real lines, and you construct a figure in your mind instead of on paper. Your imagination fulfils the office of a diagram on paper. You trust to it as you would to the diagram, and it answers equally

well, for, in the matter of figures and lines, the imagination exactly reproduces the sensation. What you have seen with your eyes open, you will see again in a precisely similar manner a moment afterwards with your eyes closed, and you can study geometrical properties transferred to the field of mental sight as accurately as in the field of actual sight. There are, then, mental experiments as there are ocular ones, and it is after such an experiment that you deny to two straight lines, even when prolonged to infinity, the property of enclosing a space. For this purpose, there is no need to follow the lines to infinity—you have merely to imagine yourself at the point where they converge, and there you have the impression of a bent line—that is, of one which is no longer straight.* Your presence there in imagina-

* For though, in order actually to see that two given lines never meet, it would be necessary to follow them to infinity; yet without doing so we may know that if they ever do meet, or if, after diverging from one another, they begin again to approach, this must take place not at an infinite, but at a finite distance. Supposing, therefore, such to be the case, we can

tion is equivalent to your actual presence; and you can affirm by it as much, and as positively, as your actual presence would have enabled you to do. The first amounts to the second in a more manageable form, with greater range and flexibility; it is like using a telescope in place of the naked eye; and, as the evidence of the telescope gives rise to propositions of experience, so will the evidence of the imagination.

Again, the argument distinguishing axioms from propositions of experience, on the ground that the contraries of the latter are conceivable while the contraries of

transport ourselves thither in imagination, and can frame a mental image of the appearance which one or both of the lines must present at that point, which we may rely on as being precisely similar to the reality. Now, whether we fix our contemplation upon this imaginary picture, or call to mind the generalizations we have had occasion to make from former ocular observation, we learn by the evidence of experience, that a line which, after diverging from another straight line, begins to approach to it, produces the impression on our senses which we describe by the expression, "a bent line," not by the expression, "a straight line."—Vol. i., p. 264.

axioms are inconceivable, is nugatory, for there is no such distinction. There is nothing to prevent the contraries of certain propositions of experience being conceivable, and the contraries of others inconceivable. It depends on the constitution of our minds. It is possible that the mind may sometimes be able to contradict its experience, and sometimes not. It is possible that our conceptions may sometimes differ from our perceptions, and sometimes not. It is possible that external sight may sometimes be opposed to internal, and sometimes not. Now, we have seen that, in the case of figures, our mental sight exactly reproduces our actual sight. Therefore, in axioms of figure, the mental sight cannot be opposed to the actual; imagination cannot contradict sensation. In other words, the contraries of such axioms will be inconceivable. Thus axioms, even though their contraries be inconceivable, are a kind of experimental truths; and it is on account of their being experimental truths that their contraries are inconceivable. At every point this

conclusion, the abridgment of the system, presents itself:—that every instructive or fruitful proposition is derived from experience, and is nothing but a connecting together of facts.

VII.

HENCE it follows that Induction is the sole key to nature. This theory is Mill's masterpiece. No one but so thorough-going a partisan of experience could have constructed the theory of Induction. What, then, is Induction? It is the operation which discovers and proves general propositions. It is the process by which we conclude that what is true of certain individuals of a class is true of all the class, or that what is true at a particular time will be true at all times, under similar circumstances.* It is the reasoning by which we

* Induction, then, is that operation of the mind, by which we infer that what we know to be true in a particular case or cases, will be true in all cases which resemble the former in certain assignable respects. In other words, Induction is the process by which we

conclude that all men will die, from having observed that Peter, John, and a greater or less number of men, have died. In short, induction connects mortality with the quality of man ; that is to say, connects two general facts found to be successive, and asserts that one of them is the Cause of the other.

This amounts to saying that the course of nature is uniform. But induction does not set out from this axiom, but leads us up to it ; we do not find it at the commencement, but at the conclusion of our researches.* At starting, experience pre-

conclude that what is true of certain individuals of a class is true of the whole class, or that what is true at certain times will be true in similar circumstances at all times.—Vol. i., p. 315.

* We must first observe, that there is a principle implied in the very statement of what Induction is ; an assumption with regard to the course of nature and the order of the universe : namely, that there are such things in nature as parallel cases ; that what happens once, will, under a sufficient degree of similarity of circumstances, happen again, and not only again, but as often as the same circumstances recur. This, I say, is an assumption, involved in every case of induction.

supposes nothing beyond itself. No *à priori* principle comes to authorise or guide her. We observe that this stone has fallen, that this coal has burnt us, that this man is dead, and we have no other means of performing induction than the collection and comparison of these little isolated and transient facts. Simple practical experience shows us that the sun gives light, that bodies fall, that water quenches thirst, and we have no other means of extending or criticising these inductions than by other similar inductions. Each observation and each induction derives its value from itself, and from similar ones. Experience is invariably the test of experience, and induction the test of induction.

The body of our knowledge has not, then, a soul distinct from it, and vivifying it; it

And, if we consult the actual course of nature, we find that the assumption is warranted. The universe, so far as known to us, is so constituted, that whatever is true in any one case, is true in all cases of a certain description; the only difficulty is, to find *what* description.—Vol. i., p. 337.

subsists by the harmony of its parts taken as a whole, and by the vitality of each part taken separately. We should disbelieve a traveller who told us of men with heads underneath their shoulders, but we should not refuse to believe a traveller who said that there were black swans, and yet our experience is the same in the two cases. We have never seen any but white swans, and have never seen men with their heads elsewhere than on their shoulders. How comes it, then, that the second testimony appears more credible to us than the first? "Apparently because there is less constancy in the colours of animals, than in their general anatomical structure. But how do we know this? Evidently by experience.* It appears,

* Why is it that, with exactly the same amount of evidence, both negative and positive, we did not reject the assertion that there are black swans, while we should refuse credence to any testimony which asserted that there were men wearing their heads underneath their shoulders? The first assertion was more credible than the latter. But why more credible? So long as neither phenomenon had been actually witnessed, what reason was there for finding the one harder to be

then, that we have need of experience to inform us in what degree, in what cases or sorts of cases, experience is to be relied on. Experience must be consulted in order to learn under what circumstances arguments from it will be valid. We have no ulterior test to which we can subject experience in general, but we make experience its own test." Experience is all we have and all we can have.

believed than the other? Apparently because there is less constancy in the colours of animals, than in the general structure of their internal anatomy. But how do we know this? Doubtless, from experience. It appears, then, that we need experience to inform us, in what degree, and in what cases, or sorts of cases, experience is to be relied on. Experience must be consulted in order to learn from it under what circumstances arguments from it will be valid. We have no ulterior test to which we subject experience in general; but we make experience its own test. Experience testifies, that among the uniformities which it exhibits or seems to exhibit, some are more to be relied on than others; and uniformity, therefore, may be presumed, from any given number of instances, with a greater degree of assurance, in proportion as the case belongs to a class in which the uniformities have hitherto been found more uniform.—Vol. i., p. 351.

Let us then consider how it is that, by experience alone, we are able to form general propositions, and especially those, the most numerous and most important of all, which connect two successive events, by saying that the first is the cause of the second.

We have here a great word, Cause; let us examine it. It comprises a whole philosophy in itself. From the notion we have of Cause depend all our notions of nature. To give a new idea of Causation is to give a new form to human thought; and we shall see how Mill, like Comte and Hume, but better than either of them, has put this idea into a new shape.

What, then, is a cause? When Mill says that the contact of iron with moist air produces rust, or that heat dilates bodies, he does not speak of the mysterious link by which metaphysicians connect cause and effect. He does not busy himself with the intimate force or generative virtue which certain philosophers insert between the thing producing and the product. "The only notion," he says, "of which induction has

need, may be attained by experience. We learn by experience that there is in nature an invariable order of succession, and that each fact is always preceded by another fact. We call the invariable antecedent, cause, and the invariable consequent, effect."* No other foundation underlies these two words. We wish simply to say that at every time, and place, the contact of iron with moisture will be followed by the appearance of rust; the application of heat by the dilation of bodies. "The real cause is the series of conditions—the whole of the antecedents without which the effect would not arrive.† . . . There is

* The only notion of a cause, which the theory of induction requires, is such a notion as can be gained from experience. The Law of Causation, the recognition of which is the main pillar of inductive science, is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in nature and some other fact which has preceded it; independently of all consideration respecting the ulterior mode of production of phenomena, and of every other question regarding the nature of "Things in themselves."—Vol. i., p. 359.

† The real Cause, is the whole of these antecedents.—Vol. i., p. 360.

no scientific foundation for distinguishing between the cause of a phenomenon and the conditions of its happening. . . . The distinction drawn between the patient and the agent is purely verbal. . . . The cause is the sum of negative and positive conditions taken together; the whole of the circumstances and contingencies of every kind, which, once given, are invariably followed by the consequence."* Much argument has been expended on the word necessary. "That which is necessary, that which cannot but be, is that which will happen, whatever suppositions may be made about other things."† That is all we mean by saying that the notion of cause includes

* The cause, then, philosophically speaking, is the sum total of the conditions, positive and negative, taken together; the whole of the contingencies of every description, which being realised, the consequent invariably follows.—Vol. i., p. 365.

† If there be any meaning which confessedly belongs to the term necessity, it is *unconditionalness*. That which is necessary, that which *must* be, means that which will be, whatever supposition we may make in regard to all other things.—Vol. i., p. 372.

that of necessity. We mean that the antecedent is sufficient and complete, that there is no need to suppose any additional antecedent, that all requisite conditions are contained in it, and that no other condition need exist. To follow unconditionally, then, is the whole notion of cause and effect. We can attain no other. Philosophers are mistaken when they discover in our will a different type of causation, and give it as an example of efficient cause in act and in exercise. Nothing of the sort is to be found there, but there, as elsewhere, we find constant successions only. We do not find fact engendering fact, but fact accompanying fact. "Our will produces our bodily actions as cold produces ice, or as a spark produces an explosion of gunpowder." There, as elsewhere, we find an antecedent—the resolution or state of mind, and a consequent—the effort or physical sensation. Experience connects them, and enables us to foresee that the effort will follow the resolution, just as it enables us to foresee that the explosion of gunpowder will follow the contact of the spark. Let us give

up, then, all psychological illusions, and seek only, under the names of cause and effect, for phenomena which form pairs without exception or condition.

Now, Mill discovers four, and only four, methods for the establishment of these connections of phenomena; namely, the Methods of Agreement, of Difference, of Residues, and of Concomitant Variations. These are the only means by which we can penetrate into nature. There are no other, and these prevail in every direction. And all of them employ the same artifice; that is to say, elimination—for induction is, in fact, nothing more than this. You have two groups, one of antecedents, and one of consequents, each of them containing more or less elements—ten, for example. To what antecedent is each consequent joined? Is the first consequent joined to the first antecedent, or to the third, or sixth? All the difficulty and the only possible solution lie here. To resolve the difficulty, and effect the solution, elimination is required, that is to say—the exclusion of those antecedents which are not connected

with the consequent we are considering. But as we are not able actually to exclude them, and as in nature the pair of phenomena we are seeking is always surrounded with circumstances, we collect different cases, which, by their diversity, enable us mentally to clear away those circumstances, and discover the pair we are in search of. In short, we can only perform induction by discovering pairs of phenomena; we can only form these pairs by elimination; we can only eliminate by means of comparisons.

On the Four Methods of Experimental Inquiry.

If we take fifty crucibles of molten matter and let them cool, and fifty solutions and let them evaporate, all will crystallize. Sulphur, sugar, alum, salt,—substances, temperatures, circumstances—all are as different as they can be. We find one, and only one, common fact—the change from the liquid to the solid state—and conclude, therefore, that this change is the invariable antecedent of crystallization. Here we have an example of the Method of Agreement. Its canon is:—

"I. If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree, is the cause (or effect) of the given phenomenon."—Vol. i., p. 422.

A bird in the air breathes; plunged into carbonic acid gas, it ceases to breathe. In other words, in the second case, suffocation ensues. In other respects the two cases are as similar as possible, since we have the same bird in both, and they take place in immediate succession. They differ only in the circumstance of immersion in carbonic acid gas being substituted for immersion in the atmosphere, and we conclude that this circumstance is invariably followed by suffocation. The Method of Difference is here employed. Its canon is:—

"II. If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two instances differ, is the effect, or the cause, or a necessary part of the cause, of the phenomenon."—Vol. i., p. 423.

[A combination of these methods is sometimes employed, and is termed the Indirect Method of Difference, or the Joint Method of Agreement and Difference. It is, in fact, a double employment of the Method of Agreement, first applying that method to instances in which the phenomenon in question occurs, and then to instances in which it does not occur. The following is its canon:—

"III. If two or more instances in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common, save the absence of

that circumstance; the circumstance in which alone the two sets of instances differ, is the effect, or the cause, or a necessary part of the cause, of the phenomenon."] —Vol. i., p. 429.

If we take two groups—one of antecedents and one of consequents—and can succeed in connecting by previous investigations all the antecedents but one to their respective consequents, and all the consequents but one to their respective antecedents, we conclude that the remaining antecedent is connected to the remaining consequent. For example, scientific men had calculated what ought to be the velocity of sound according to the laws of the propagation of sonorous waves, but found that a sound actually travelled quicker than their calculations had indicated. This surplus or residue of speed was a consequent for which an antecedent had to be found. Laplace discovered the antecedent in the heat developed by the condensation of each sonorous wave, and this new element, when introduced into the calculation, rendered it perfectly accurate. This is an example of the Method of Residues, the canon of which is as follows :—

"IV. Subduct from any phenomenon such part as is known by previous inductions to be the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedents."—Vol. i., p. 431.

Let us take two facts—as the presence of the earth and the oscillation of the pendulum, or again the presence of

the moon and the flow of the tide. To connect these phenomena directly, we should have to suppress the first of them and see if this suppression would occasion the stoppage of the second. Now, in both instances, such suppression is impossible. So we employ an indirect means of connecting the phenomena. We observe that all the variations of the one correspond to certain variations of the other; that all the oscillations of the pendulum correspond to certain different positions of the earth; that all states of the tide correspond to positions of the moon. From this we conclude that the second fact is the antecedent of the first. These are examples of the Method of Concomitant Variations. Its canon is:—

"V. Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation."—Vol. i., p. 435.

"The Method of Agreement," says Mill (vol. i., p. 424), "stands on the ground that whatever can be eliminated, is not connected with the phenomenon by any law. The Method of Difference has for its foundation, that whatever can *not* be eliminated, *is* connected with the phenomenon by a law." The Method of Residues is a case of the Method of Differences. The Method of Concomitant Variations is another case of the same method; with this distinction, that it is applied, not to the phenomena, but to their variations.

VIII.

THESE are the rules: an example will make them clearer. We will take Dr. Wells's theory of dew, which will show you the methods in exercise. Nearly all of them are employed in it. I will give it you in Mill's own words, which are so clear that you must have the pleasure of considering them.*

We must begin by separating dew from rain, and the moisture of fogs, and by defining it as "the spontaneous appearance of moisture on substances exposed in the open air, when no rain or visible wet is falling." What is the cause of the phenomena we have thus defined, and how was that cause discovered?

* Vol. i., pp. 451—9. Mr. Mill quotes from Sir John Herschel's Discourse on the Study of Natural Philosophy.

In the first place, "'we have analogous phenomena in the moisture which bedews a cold metal or stone when we breathe upon it; that which appears on a glass of water fresh from the well in hot weather; that which appears on the inside of windows when sudden rain or hail chills the external air; that which runs down our walls when, after a long frost, a warm moist thaw comes on.' Comparing these cases, we find that they all contain the phenomenon which was proposed as the subject of investigation. Now, 'all these instances agree in one point, the coldness of the object dewed, in comparison with the air in contact with it.' But there still remains the most important case of all, that of nocturnal dew: does the same circumstance exist in this case? 'Is it a fact that the object dewed *is* colder than the air? Certainly not, one would at first be inclined to say; for what is to *make* it so? But . . . the experiment is easy: we have only to lay a thermometer in contact with the dewed substance, and to hang one at a little distance above it, out of reach of its influ-

ence. The experiment has therefore been made; the question has been asked, and the answer has been invariably in the affirmative. Whenever an object contracts dew, it *is* colder than the air.'

"Here then is a complete application of the Method of Agreement, establishing the fact of an invariable connection between the deposition of dew on a surface, and the coldness of that surface compared with the external air. But which of these is cause, and which effect? or are they both effects of something else? On this subject the Method of Agreement can afford us no light: we must call in a more potent method. 'We must collect more facts, or, which comes to the same thing, vary the circumstances; since every instance in which the circumstances differ is a fresh fact: and especially, we must note the contrary or negative cases, *i. e.*, where no dew is produced:' a comparison between instances of dew and instances of no dew, being the condition necessary to bring the Method of Difference into play.

"'Now, first, no dew is produced on the surface of polished metals, but it *is* very copiously on glass, both exposed with their faces upwards, and in some cases the horizontal under side of a horizontal plate of glass is also dewed.' Here is an instance in which the effect is produced, and another instance in which it is not produced; but we cannot yet pronounce, as the canon of the Method of Difference requires, that the latter instance agrees with the former in all its circumstances except one; for the differences between glass and polished metal are manifold, and the only thing we can as yet be sure of is, that the cause of dew will be found among the circumstances by which the former substance is distinguished from the latter." To detect this particular circumstance of difference we have but one practicable method, that of Concomitant Variations. "'In the cases of polished metal and polished glass, the contrast shows evidently that the *substance* has much to do with the phenomenon; therefore let the substance *alone* be diversified as much as

possible, by exposing polished surfaces of various kinds. This done, a *scale of intensity* becomes obvious. Those polished substances are found to be most strongly dewed which conduct heat worst; while those which conduct well, resist dew most effectually.'" Hence we conclude, that "*cæteris paribus* the deposition of dew is in some proportion to the power which the body possesses of resisting the passage of heat; and that this, therefore, (or something connected with this,) must be at least one of the causes which assist in producing the deposition of the dew on the surface. 'But if we expose rough surfaces instead of polished, we sometimes find this law interfered with. Thus, roughened iron, especially if painted over or blackened, becomes dewed sooner than varnished paper: the kind of *surface*, therefore, has a great influence. Expose, then, the *same* material in very diversified states as to surface' (that is, employ the Method of Difference to ascertain concomitance of variations,) 'and another scale of intensity becomes at once

apparent; those *surfaces* which *part with their heat* most readily by radiation, are found to contract dew most copiously.'" Hence we conclude, "that *cæteris paribus* the deposition of dew is also in some proportion to the power of radiating heat; and that the quality of doing this abundantly (or some cause on which that quality depends) is another of the causes which promote the deposition of dew on the surface. 'Again, the influence ascertained to exist of *substance* and *surface* leads us to consider that of *texture:* and here, again, we are presented on trial with remarkable differences, and with a third scale of intensity, pointing out substances of a close firm texture, such as stones, metals, &c., as unfavourable, but those of a loose one, as cloth, velvet, wool, eider-down, cotton, &c., as eminently favourable to the contraction of dew.' The Method of Concomitant Variations is here, for the third time, had recourse to; and, as before, from necessity, since the texture of no substance is absolutely firm or absolutely loose. Looseness of texture, therefore, or

something which is the cause of that quality, is another circumstance which promotes the deposition of dew ; but this third cause resolves itself into the first, *viz.*, the quality of resisting the passage of heat: for substances of loose texture 'are precisely those which are best adapted for clothing, or for impeding the free passage of heat from the skin into the air, so as to allow their outer surfaces to be very cold, while they remain warm within.'

"It thus appears that the instances in which much dew is deposited, which are very various, agree in this, and, so far as we are able to observe, in this only, that they either radiate heat rapidly or conduct it slowly : qualities between which there is no other circumstance of agreement, than that by virtue of either, the body tends to lose heat from the surface more rapidly than it can be restored from within. The instances, on the contrary, in which no dew, or but a small quantity of it, is formed, and which are also extremely various, agree (as far as we can observe) in nothing except in *not*

having this same property." We can now revert to our previous inquiry as to whether the coldness was the cause of dew, or its effect. "This doubt we are now able to resolve. We have found that, in every such instance, the substance on which dew is deposited, is one, which, by its own properties or laws, would, if exposed in the night, become colder than the surrounding air. The coldness therefore, being accounted for independently of the dew, while it is proved that there is a connection between the two, it must be the dew that depends on the coldness; or in other words, the coldness is the cause of the dew.

"This law of causation, already so amply established, admits, however, of efficient additional corroboration in no less than three ways. First, by deduction from the known laws of aqueous vapour when diffused through air or any other gas; and though we have not yet come to the Deductive Method, we will not omit what is necessary to render this speculation complete. It is known by direct experiment that only a

limited quantity of water can remain suspended in the state of vapour at each degree of temperature, and that this maximum grows less and less as the temperature diminishes. From this it follows, deductively, that if there is already as much vapour suspended as the air will contain at its existing temperature, any lowering of that temperature will cause a portion of the vapour to be condensed, and become water. But, again, we know deductively, from the laws of heat, that the contact of the air with a body colder than itself, will necessarily lower the temperature of the stratum of air immediately applied to its surface ; and will therefore cause it to part with a portion of its water, which accordingly will, by the ordinary laws of gravitation or cohesion, attach itself to the surface of the body, thereby constituting dew. This deductive proof, it will have been seen, has the advantage of proving at once causation as well as co-existence ; and it has the additional advantage that it also accounts for the *exceptions* to the occurrence of the phenomenon,

the cases in which, although the body is colder than the air, yet no dew is deposited; by showing that this will necessarily be the case when the air is so under-supplied with aqueous vapour, comparatively to its temperature, that even when somewhat cooled by the contact of the colder body, it can still continue to hold in suspension all the vapour which was previously suspended in it: thus in a very dry summer there are no dews, in a very dry winter no hoar-frost.

"The second corroboration of the theory is by direct experiment, according to the canon of the Method of Difference. We can, by cooling the surface of any body, find in all cases some temperature, (more or less inferior to that of the surrounding air, according to its hygrometrical condition,) at which dew will begin to be deposited. Here, too, therefore, the causation is directly proved. We can, it is true, accomplish this only on a small scale; but we have ample reason to conclude that the same operation, if conducted in Nature's great laboratory, would equally produce the effect.

"And, finally, even on that great scale we are able to verify the result. The case is one of those rare cases, as we have shown them to be, in which nature works the experiment for us in the same manner in which we ourselves perform it; introducing into the previous state of things a single and perfectly definite new circumstance, and manifesting the effect so rapidly that there is not time for any other material change in the pre-existing circumstances. 'It is observed that dew is never copiously deposited in situations much screened from the open sky, and not at all in a cloudy night; but, *if the clouds withdraw, even for a few minutes, and leave a clear opening, a deposition of dew presently begins*, and goes on increasing. . . . . Dew formed in clear intervals will often even evaporate again when the sky becomes thickly overcast.' The proof, therefore, is complete, that the presence or absence of an uninterrupted communication with the sky causes the deposition or non-deposition of dew. Now, since a clear sky is nothing but the absence of clouds, and it is

a known property of clouds, as of all other bodies between which and any given object nothing intervenes but an elastic fluid, that they tend to raise or keep up the superficial temperature of the object by radiating heat to it, we see at once that the disappearance of clouds will cause the surface to cool ; so that Nature, in this case, produces a change in the antecedent by definite and known means, and the consequent follows accordingly : a natural experiment which satisfies the requisitions of the Method of Difference."

IX.

These four are not all the methods of science, but they lead us up to the others. They are all connected: and no one has pointed out their connection so well as Mill. These processes of isolation are ineffectual in many cases; namely, in those in which the effect is produced by a concurrence of causes, and cannot therefore be reduced into its elements. Methods depending on isolation are then impracticable. We cannot eliminate, and so cannot perform induction. This grave difficulty presents itself in almost all cases of movement: for nearly every movement is the effect of a concurrence of forces, and the respective effects of the different forces are found so mixed up in it, that we cannot separate them without destroying it, and it seems impossible to know what part

each force has in the production of the movement.

Take, for instance, a body acted on by two forces whose directions form an angle. It moves along the diagonal. Each element of its movement at any moment—the force, the speed, the position—is the combined effect of the two impelling forces. Their several effects are so intimately combined that we cannot isolate either of them, and refer it to its causing force. To perceive the effects separately, we should have to consider the movements apart—that is, to suppress the actual movement and replace it by others. Neither the Method of Agreement, nor of Difference, nor of Residues, nor of Concomitant Variations, which are all decomposing and eliminative, can serve us with a phenomenon which by its nature excludes all elimination, and all decomposition. We must therefore evade the obstacle; and here it is that we avail ourselves of Deduction—the last key to nature. Abandoning the study of the actual phenomenon, we turn to simpler cases; we establish their

laws, and we connect each to its cause by the ordinary methods of induction. Then, assuming the concurrence of two or more of these causes, we determine from their known laws what will be their total effect. We then examine whether the actual movement corresponds precisely to the predicted movement; and if so, we attribute it to the causes from which we have deduced it. Thus, to discover the causes of the planetary motions, we seek by simple induction the laws of two causes: the one being the force of primitive impulsion in the direction of the tangent, and the other an accelerating attracting force. From these laws obtained by induction, we deduce by calculation the movement of a body under their combined influence; and having verified that the observed planetary movements coincide exactly with the predicted movements, we conclude that the two forces in question are actually the causes of the movements in question. "To the Deductive Method," says Mill, "the human mind is indebted for its most conspicuous triumphs in the investigation

of nature. To it we owe all the theories by which vast and complicated phenomena are embraced under a few simple laws." Our deviations have served us better than the direct path. We have derived efficiency from imperfection.

X.

If now we compare the two methods—their aptitude, their functions, their provinces—we shall find, in epitome, the history, divisions, hopes, and limits of human knowledge. The first belongs to its earliest, the other to its later stages. The first became predominant in Bacon's time,* and is losing its relative importance; the latter, which then lost its supremacy, is now beginning to regain it. So that science, having passed from the deductive to the experimental state, is now passing from the experimental to the deductive. Induction has for its province phenomena which are capable of being decomposed, and on which we are able to experiment. Deduction has for its province phenomena which are not capable of being

* Vol. i., p. 526.

decomposed, or on which we cannot experiment. The first is efficacious in physics, chemistry, zoology, and botany, in the earlier stages of each science, and, above all, when the phenomena are comparatively simple, within our reach, and capable of being modified by means at our disposal. The second is efficacious in astronomy, in the higher branches of physics, in physiology, in history, in the higher grades of each science, and, above all, where the phenomena are very complicated, as in animal and social life, or placed beyond our reach, as the movements of the heavenly bodies, and the changes of the atmosphere. When the proper method is not employed, science is at a stand-still: when it is employed, science advances. Here lies the whole secret of its past and present states. If the physical sciences were stationary till the time of Bacon, it was because deduction was employed, when there was need of induction. If physiology and the moral sciences are now making slow progress, it is because we attempt induction when deduction should be

employed. It is by deduction, and from the laws of physics and chemistry, that physiological phenomena must be explained. It is by deduction, and from the laws of the mind, that historical phenomena are capable of explanation.* And that which has become the instrument of these two sciences, it is the object of all the others to employ. All tend to become deductive, and aim at being summed up in a few general propositions, from which the rest may be deduced. The fewer these propositions are, the fewer suppositions and postulates a science requires, the more advanced and perfect it has become. Such a reduction is its final state. Astronomy, acoustics, and optics afford us models. We shall be acquainted with nature when we shall have deduced its millions of facts from two or three laws.

* See Chapter 9, Book vi., v. 2, p. 478, on the Physical or Concrete Deductive Method as applied to Sociology; and Chapter 13, Book iii, for explanations, after Liebig, of Decomposition, Respiration, the action of poisons, &c. A whole book is devoted to the logic of the moral sciences; I know no better treatise on the subject.

I venture to say that the theory which you have just heard is perfect. I have omitted many of its characteristics, but you have seen enough of it to recognise that nowhere has induction been explained so completely and precisely, with such an abundance of fine and just distinctions, with such exact and extensive applications, with such a knowledge of actual practice and of acquired discoveries, with so complete an exclusion of *à priori* principles and of metaphysical suppositions, and in a spirit more in conformity with the rigorous procedure of modern experimental science.

You asked me, just now, what we had effected in philosophy. I reply, the theory of Induction. Mill is the last of that great line of philosophers, commencing with Bacon, and continued through Hobbes, Newton, Locke, Hume, and Herschell, to our own times. They have applied our national spirit to philosophy; they have been positive and practical; they have not soared above their facts; they have not attempted extraordinary paths; they have purged the

mind of its illusions, presumptions, and dreams; they have employed it in the only direction in which it is capable of acting. All they have aimed at has been to light and mark out the already trodden ways of the progressive sciences. They have refused to spend their labour in other than explored and verified paths; they have aided the great modern work, the discovery of applicable laws; they have contributed, as cultivators of special sciences do, to the increase of man's power. Find me many philosophers who have done as much.

XI.

You will tell me that our philosopher has cut off his wings to strengthen his legs. True : and he has acted wisely. Experience marks out the career which she opens to us ; she gives us an object to aim at ; but also lays down limits within which we are confined. We have but to regard the elements of which our experience is composed, and the facts from which it sets out, to understand that its range is limited. Its nature and its method confine its progress to a few steps. And first of all,* the ultimate laws of nature cannot possibly be less numerous than the several distinct species of our sensations. We can easily reduce a movement to another movement, but not the sensation of heat to that of smell, or of colour, or of

* Vol. ii., p. 4.

sound, nor one nor the other to a movement. We can easily connect together phenomena differing in degree, but not phenomena differing in species. We find distinct sensations at the bottom of all our knowledge, as simple indecomposable elements absolutely separate one from another; absolutely incapable of being reduced one to another. Let experience do what she will, she cannot suppress the diversities on which she is founded. Again, do what she will, she cannot escape from the conditions she acts under. Whatever may be her province, it is bounded by time and space: the fact which she observes is limited and influenced by an infinite number of other facts to which she cannot attain. She is obliged to suppose or to recognise some primordial state whence she starts, and which she cannot explain.*

* There exist in nature a number of Permanent Causes, which have subsisted ever since the human race has been in existence, and for an indefinite and probably an enormous length of time previous. The sun, the earth, and planets, with their various constituents, air, water, and the other distinguishable substances, whether simple or compound, of which nature

Every problem has its accidental or arbitrary data; from these the rest may be deduced, but there is nothing from which these can be deduced. The sun, the earth, the planets, the initial impulsion of the heavenly bodies, the primitive chemical properties of substances, are such facts.* By

is made up, are such Permanent Causes. They have existed, and the effects or consequences which they were fitted to produce have taken place, (as often as the other conditions of the production met,) from the very beginning of our experience. But we can give no account of the origin of the Permanent Causes themselves.—Vol. i., p. 378.

* The resolution of the laws of the heavenly motions established the previously unknown ultimate property of a mutual attraction between all bodies: the resolution, so far as it has yet proceeded, of the laws of crystallization, or chemical composition, electricity, magnetism, &c., points to various polarities, ultimately inherent in the particles of which bodies are composed; the comparative atomic weights of different kinds of bodies were ascertained by resolving, into more general laws, the uniformities observed in the proportions in which substances combine with one another; and so forth. Thus, although every resolution of a complex uniformity into simpler and more elementary laws has an apparent tendency to diminish the number of the ultimate properties, and really does remove many pro-

the help of these all things are capable of explanation, but these themselves we cannot explain. Why, asks Mill, did these particular natural agents exist originally, and no others? —why are they commingled in such and such proportions ?—and why distributed in such and such a manner throughout space ? Here, he says, is a question we cannot answer, and, more than this, we can discover nothing regular in the distribution itself; we can reduce it to no uniformity, to no law. The assemblage of these agents can be nothing more to us than a pure accident.* And

perties from the list; yet, (since the result of this simplifying process is to trace up an ever greater variety of different effects to the same agents,) the further we advance in this direction, the greater number of distinct properties we are forced to recognise in one and the same object: the coexistences of which properties must accordingly be ranked among the ultimate generalities of nature.—Vol. ii., p. 108.

* Why these particular natural agents existed originally and no others, or why they are commingled in such and such proportions, and distributed in such and such a manner throughout space, is a question we cannot answer. More than this: we can discover nothing regular in the distribution itself; we can reduce

astronomy, which afforded us just now the model of a perfected science, now affords us an example of a limited science. We can predict the innumerable positions of all the planetary bodies, but are obliged to assume not only their primitive impulsion and its amount, not only the force and law of attraction, but also the masses and distances of all the bodies in question. We comprehend millions of facts, but it is by means of some hundred facts which we do not comprehend. We attain necessary consequences, but it is by means of accidental antecedents; so that, if the theory of our universe were completed, there would remain two great blanks: one at the commencement of the physical world; and one at the commencement of the moral world; the one comprising the elements of being; the other the elements of experience: the one relating to primitive sensations; the

it to no uniformity, to no law. There are no means by which, from the distribution of these causes or agents in one part of space, we could conjecture whether a similar distribution prevails in another.—Vol. i., p. 378.

other to primitive agents. "Our knowledge" says Royer Collard, "consists in driving back ignorance as far as possible."

Can we even affirm that these irreducible facts are so in appearance only, and in consequence of the laws of our mind? Can we assert that they have causes like the derived facts whose causes they are? Can we conclude that every event, at every period of time, and every part of space, happens according to law, and that this little world of ours, so full of uniformity, is a sort of epitome of the universe? Can we, by the aid of axioms, leave our confined precinct and affirm anything of the universe? In no way. And here it is that Mill pushes his principle to its furthest consequences. For the law which attributes a cause to every event, has to him no other foundation, value, or extent than what it derives from experience. It has no inherent necessity; it derives all its authority from the great number of cases in which it has been recognised to be true; it does but sum up a mass of observations; it connects two states

of facts which, considered in themselves, have no intimate connection ; it joins antecedents generally to consequents generally, just as the law of gravitation joins a particular antecedent to a particular consequent; it establishes a couple, as do all experimental laws, and participates in their uncertainty as in their restrictions. Listen to this bold assertion ; "I am convinced that any one accustomed to abstraction and to analysis, who will fairly exercise his faculties for the purpose, will, when his imagination has once learnt to entertain the notion, find no difficulty in conceiving that in some one, for instance, of the many firmaments into which sidereal astronomy now divides the universe, events may succeed one another at random, without any fixed law ; nor can anything in our experience, or in our mental nature, constitute a sufficient, or indeed any, reason for believing that this is nowhere the case." *

* I am convinced that any one accustomed to abstraction and analysis, who will fairly exert his faculties for the purpose, will, when his imagination has once learnt to entertain the notion, find no difficulty in conceiving

Practically we may trust in so well-established a law, but "in distant parts of the stellar regions where the phenomena may be entirely unlike those with which we are acquainted, it would be folly to affirm confidently that this general law prevails, any more than those special laws which we have found to hold universally on our own planet." *

that in some one, for instance, of the many firmaments into which sidereal astronomy now divides the universe, events may succeed one another at random, without any fixed law; nor can anything in our experience, or in our mental nature, constitute a sufficient, or indeed any, reason for believing that this is nowhere the case. The grounds, therefore, which warrant us in rejecting such a supposition with respect to any of the phenomena of which we have experience, must be sought elsewhere than in any supposed necessity of our intellectual faculties.—Vol. ii., p. 95.

* In distant parts of the stellar regions where the phenomena may be entirely unlike those with which we are acquainted, it would be folly to affirm confidently that this general law prevails, any more than those special ones which we have found to hold universally on our own planet. The uniformity in the succession of events, otherwise called the law of causation, must be received not as a law of the universe, but of that portion of it only which is within the range of our means of sure observation, with a reasonable degree of

We are, then, inevitably driven back from the infinite; our faculties and our assertions can in no way attain to it; we remain confined in a very small circle; our mind cannot carry itself beyond the range of its experience; we cannot establish any universal and necessary connection between facts; perhaps, indeed, no such universal and necessary connection exists. Mill stops here. But there can be no doubt, that by carrying out his idea to its full extent, we should arrive at the conception of the world as a simple collection of facts, the existence and connections of which would be attributable to no internal necessity, but which would be simple arbitrary accidentally-existing facts. Sometimes, as in our system, they would be found assembled in such a way as to bring about regular recurrences; sometimes they would be so assembled that

extension to adjacent cases. To extend it further is to make a supposition without evidence, and to which, in the absence of any ground from experience for estimating its degree of probability, it would be idle to attempt to assign any. Vol. ii., p. 104.

nothing of the sort would occur. Chance would be, as Democritus taught, at the foundation of all things. Laws themselves would be the result of chance, and sometimes we should find them, sometimes not. It would be with things, as it is with some numbers—decimal fractions, for example, which, according to the hazard of what may be their two primitive factors, sometimes recur regularly, and sometimes not. Here is, no doubt, a high and original conception. It is the final consequence of the primitive leading idea, which we discovered at the commencement of the system, which has transformed the theories of Definition, of Propositions, and of the Syllogism; which has reduced axioms to truths of experience; which has developed and brought to perfection the theory of induction; which has established the aim, the limits, the province, and the methods of science; which has everywhere, in nature and in science, suppressed all interior connections; which has replaced the necessary by the accidental; cause by antecedent; and which consists in

maintaining that every assertion which is not merely verbal, forms in effect a couple—that is to say, joins together two facts which were separate by their nature.

§ II.

ABSTRACTION.

I.

An abyss of chance, and an abyss of ignorance. The prospect is sombre; but what matter, if it be true? At all events, in this theory of science we have the theory of English science. Seldom, I grant you, has a thinker better summed up in his teaching the practice of his country; seldom has any one set forth, both by his denials and his assertions, the limits and the province of his race. The operations of which he composes science are those in which you specially excel, and those which he excludes from science are the ones in which you are, of all nations, the most deficient. He has given us a description of the English, for that of

the human mind. Here, too, lies his merit, and here his weakness. In your idea of knowledge there is a flaw, and its incessant repetition ends by creating the gulf of chance, from which, according to his teaching, all things arise, and the gulf of ignorance, at whose brink, he tells us, our knowledge ends. And see what happens. By cutting away from science the knowledge of first causes—that is, of divine things—you drive men to become sceptical, positive, utilitarian, if they are cool-headed; or mystical, enthusiastic, methodistical, if they have lively imaginations. In the huge unknown void which you create beside our little world, men with hot heads and uneasy consciences find room for all their dreams; while men of cool judgment, despairing of arriving at any sure knowledge, have nothing left but to bring themselves down to the search for practical truths which may serve to ameliorate our condition. It seems to me, that these two dispositions frequently co-exist in an English mind. The religious and positive spirits dwell there

side by side, but separate. They form a strange alliance, and I confess that I prefer the way in which the Germans have reconciled science with faith.

"But their philosophy is but an ill-written poetry."—"Perhaps so."—"But what they call reason, or intuition of principles, is but the faculty of building up hypotheses."—"Perhaps so."—"But the systems they have constructed have not held their ground before experience."—"I do not defend what they have done."—"But their absolute, their subject, their object, and the rest, are but big words."—"I give you up their style."—"What, then, do you defend?"—"Their idea of Causation."—"You believe with them that causes are discovered by a revelation of the reason?"—"Not at all."—"You believe, then, with us, that our knowledge of causes is founded on simple experience?"—"Still less."—"Is there, then, a faculty other than experience and reason capable of discovering causes?"—"Yes."—"You think there is a middle course situated between illumination and observation, capable of arriving at

principles, as they tell us that the first is, capable of arriving at truths as we find the second is?"—"Yes."—"What then?"—"Abstraction. Let us return to your original idea. I will attempt to show you where I find it incomplete, and how you appear to me to mutilate the human mind. But you must give me space: it will be the connected argument of an advocate."

II.

Your starting-point is correct. In fact, man knows nothing of substances; he knows nothing of minds or bodies; he is conscious only of his transient, isolated, internal states. He avails himself of these to assert and name exterior states, positions, movements, and changes, and avails himself of them for this purpose only. All he can attain to are facts, internal or external; sometimes transient, when his impression is not repeated; sometimes permanent, when his impression, frequently repeated, leads him to believe that it will be so whenever and as often as he pleases. All he grasps are colours, sounds, resistances, and movements—sometimes momentary and variable, sometimes constant and renewed. To group these facts he supposes, by means of an artifice of language,

the existence of qualities and properties. We go even further than you: we think that there are neither minds nor bodies, but simply groups of present or possible movements, and groups of present or possible thoughts. We believe that there are no substances, but only systems of facts. We look on the notion of substance as a psychological illusion. We consider substance, force, and all the metaphysical existences of the moderns as the remains of scholastic entities. We think the world consists of facts and laws; of events and the relations between them; and we admit, with you, that all we know may be reduced to the connection or addition of fact to fact. But when this is accomplished a new operation commences, the most fruitful of all, consisting in the reduction of complex into simple facts. A magnificent faculty comes into play, the origin of language, the interpreter of nature, the parent of religions and philosophies, the only real distinction which, according to its degree, separates man from the brute, and great from ordinary men. I

mean Abstraction: the power of isolating the elements of facts, and of considering them separately. My eyes follow the outline of a square, and from it abstraction derives its two constituent properties—the equality of its sides and angles. My fingers touch the surface of a cylinder, and from it abstraction derives its two generating elements—the idea of a rectangle, and of the revolution of this rectangle about one of its sides as an axis. A hundred thousand facts of experience display to me, by an infinite number of details, the series of physiological operations which make up life, and abstraction derives the law of this series, which is a round of constant loss and continual reparation. Twelve hundred pages teach me Mill's views on the different facts of science, and abstraction derives his leading idea:—that those propositions only are fruitful which connect a fact to another not contained in the first. The case is the same everywhere. A fact, or series of facts, may always be resolved into its components. This resolution it is which forms our problem

when we inquire into the nature of an object. These components are what we are in search of when we attempt inquiries into the inner nature of a being. These are what pass under the names of forces, causes, laws, essences, primitive properties. They are not new facts added to the first, but a portion or extract of them; they are contained in them, and have no existence apart from the facts themselves. To discover them we do not pass from one fact to a different one, but from one to another aspect of the same fact; from the whole to a part, from the compound to the components. All we do is to look at the same thing under two forms; first, as a whole, then, as divided: to translate our idea from one language into another, from the language of the senses into abstract language, just as we express a curve by an equation, or a cube as a function of its side.

It matters little whether this translation be difficult or not; whether it may not require the accumulation or comparison of an immense number of facts, and whether

our mind may not often succumb before accomplishing it. However this may be, it invariably happens that in this operation, which is evidently a fruitful one, instead of passing from fact to fact we are employed with one and the same fact ; instead of adding portion to portion of experimental knowledge, we set aside a portion of the first ; instead of advancing, we stop to examine the ground we stand on. There are, then, judgments which, though instructive, are not the results of experience ; there are propositions which, though essential, are not merely verbal ; there is an operation, differing from experience, which acts by retrenchment instead of addition ; which instead of acquiring, devotes itself to what has been acquired, and which, going farther than observation, opens a new field to the sciences, defines their nature, determines their progress, completes their resources, and marks out their end.

This is the great omission of your system. It leaves Abstraction in the background, barely mentioned, hidden by the other ope-

rations of the mind, and treated as an appendage of Experience; we have but to re-establish it in the general theory, in order to enable us to reform its particular branches in the points in which they are deficient.

III.

To commence with Definitions. Mill teaches that there can be no definitions of things, and that when you define a sphere as the solid generated by the revolution of a semicircle about its diameter, you only define a name. That such a proposition teaches the meaning of a name is unquestionable, but it also teaches a good deal more. It asserts that all the properties of every sphere may be derived from this generating formula. It reduces an infinitely complex system of facts to two elements. It transforms sensible into abstract facts. It expresses the essence of the sphere—that is to say, the internal primordial cause of all its properties. Such is the nature of every true definition ; it is not confined to the explanation of a name ; it is not a mere description ; it does not simply point out a distinctive property ; its office is not limited to ticketing an object so as to

distinguish it from all others. There are many ways of indicating the object besides its definition; there are other properties which belong exclusively to it; a sphere might be described by saying that it is that of all bodies which, with equal surface, occupies the most space, or in many other ways. But such descriptions are not definitions; they express a characteristic, derived quality, not a generating and primitive one. They do not reduce the thing to its factors and reconstruct it under our eyes; they do not show its inner nature and its irreducible elements. A definition is a proposition which marks out in an object that quality from which its others are derived, but which is not itself derived from any other. Such a proposition is not verbal, for it teaches the quality of a thing. It is not the affirmation of an ordinary quality, for it shows us the quality which is the source of the rest. It is an assertion of an extraordinary kind, the most fruitful and precious of all, which sums up a whole science, and in which it is the aim of every science to be

summed up. There is a definition appertaining to each science, and one for each object. It is what we have not always arrived at, but at which we are always attempting to arrive. We have arrived at defining the motion of the planets, by the tangential force and central attraction of which it is compounded ; we can now partly define a chemical body by the notion of equivalent, and a living body by the notion of type. We strive to transform each group of phenomena into certain laws, forces, or abstract notions. We endeavour to attain to the generating elements in each object as we do attain them in the sphere, cylinder, circle, cone, and other mathematical loci. We reduce natural bodies to two or three sorts of movement—attraction, vibration, polarization—as we reduce geometrical bodies to two or three sorts of elements—the point, the movement, the time ; and we pronounce our science to be partial or complete, provisional or definite, accordingly as this reduction is approximate or absolute, imperfect or complete.

IV.

The Theory of Proof requires similar alteration. According to Mill, the proof of the mortality of a living man is not derived from the premiss that all men are mortal, for that would amount to asserting the same thing twice over, but from the facts of the deaths of John, Peter, and others; in short, of all those of whom we have ever heard. I answer that the real source of our inference lies elsewhere, and is neither the mortality of John, Peter, and others, nor the mortality of all men. A fact is proved, says Aristotle, by pointing out its cause.* We shall prove, then, the mortality of Prince Albert, by giving a reason why he will die. And what reason is there? except that the

* See the Posterior Analytics, which are much superior to the Prior—*δι' αἰτίων καὶ προτέρων.*

human body, being an unstable chemical compound, must in time be resolved; in other words, because mortality is joined to the quality of man. Here is the cause, and the proof. It is this abstract law which, present in nature, will cause the Prince's death, and the presence of which to my mind shows me that he will die. What really proves this is the abstract proposition; not the series of particular propositions, nor the concrete general proposition. In fact, the abstract proposition proves the others. If John, Peter, and others, are dead, it is because mortality is joined to the quality of man. If all men are dead, or will die, it is still because mortality is joined to the quality of man. Here, once more, the part played by Abstraction has been overlooked. Mill has confounded it with Experience. He has not distinguished the proof from the materials of the proof, the abstract law from the finite or indefinite number of its applications. The applications comprise both proof and law, but are themselves neither proof nor law. The examples of

Peter, John, and others, contain the cause; but they are not the cause. It is not enough to add up the cases; we must extract from them the law. Experiments alone will not do, abstraction is necessary. Here we have the great scientific operation. Syllogism does not pass from the particular to the particular, as Mill teaches, nor from the general to the particular, as is taught by ordinary logicians, but from the abstract to the concrete—that is to say, from the cause to the effect. This is its title to form part of science, the links of which it makes and marks out; it connects principles with effects; it brings together the definition and the phenomenon. It diffuses over the whole range of science that Abstraction which definition has carried to its height.

V.

Axioms, again, are explained by Abstraction. According to Mill, if we know that when equal magnitudes are added to equal magnitudes the wholes are equal, or that two straight lines cannot enclose a space, it is by external ocular experiment, or by an internal experiment by the aid of imagination. No doubt it is possible thus to arrive at the conclusion that two straight lines cannot enclose a space ; but there are other ways of doing so. We can represent lines in imagination, but can also form conceptions of them by reason. We can either study their form or their definition. We can either study the line itself or its generating elements. I can picture to myself a line ready drawn, but can also resolve it into its elements. I can go back to its for-

mation and discover the abstract elements of which it is composed, as in the case of a cylinder we find that it is generated by the revolution of a rectangle. It will not do to say that a straight line is the shortest from one point to another, for that is a derived property, but we may call it the line described by a point which moves towards another point, and towards that point only; and this amounts to saying that two points are sufficient to determine a straight line; in other words, that two straight lines, having two points in common, coincide in their entire length; whence it appears, that when the two straight lines approach to enclose a space, they become one straight line, and so, nothing is enclosed. Here we have another way of arriving at a knowledge of the axiom, and it evidently differs considerably from the first. In the first we verify it, in the second we deduce it. In the first we find by experience that it is true, in the second we prove it to be true. The first compels us to admit its truth, the second explains how it is true; the first merely

shows the contrary of the axiom to be inconceivable, the second further shows that its contrary would involve a contradiction. When we are given the definition of a straight line, we find that the axiom that two straight lines cannot enclose a space is comprised in it, and may be derived from it, as a consequent from a principle. It is nothing more, in fact, than an identical proposition—that is to say, its subject contains its attribute. It does not connect two terms which are separate and irreducible one to the other, but brings together two, the second of which is a part of the first. It is merely an analysis, and this is the case with all axioms. We have only to decompose them, to see that they do not pass from an object to a different one, but are concerned with one object only. We have but to resolve the notions of equality, cause, substance, time, and space into their abstracts, in order to demonstrate the axioms of equality, substance, cause, time, and space. There is only one axiom—that of identity. The others are applications, or consequences of it.

When this is admitted, it appears at once that the range of our mind is altered. We are no longer capable only of relative and limited knowledge, but also of infinite and absolute knowledge. We possess in axioms facts which do not merely accompany one another, but the one of which includes the other. If they only accompanied one another, as Mill says, we should be driven to conclude with him that this might not always be the case. We should see no internal necessity for their connection, and should not admit it except as far as our experience went; we should say that the two facts being isolated in their nature, circumstances might be found in which they would be separate. We should only affirm the truth of axioms relatively to our world and mind. If, on the contrary, the two facts are such that the one includes the other, we should thus establish the necessity of their connection: wherever the first may be found it will bring the second with it, since the second is a part of itself, and therefore inseparable from it. No circumstance

can exist between them, and disconnect them, for they make but one thing under different aspects. Their connection, then, is absolute and universal; and we possess truths subject neither to limitation, to condition, nor restriction. Abstraction restores their value to axioms, by showing their origin, and we restore to science her dispossessed dominion, by restoring to the mind the faculty of which it was deprived.

VI.

Induction remains to be considered, and seems to be the triumph of pure experience, while, in fact, it is the triumph of abstraction. When I discover that cold produces dew, and that the passage from the liquid to the solid state produces crystallization, I establish a connection between two abstract facts. Neither cold, nor dew, nor the passage from the liquid to the solid state, nor crystallization, exist in themselves. They are portions of phenomena, extracts from complex cases, simple elements included in compound wholes. I draw them thence, and isolate them. I isolate dew in general from all local, temporary, special dews which I observe. I isolate cold in general from all the special, various, distinct colds which may be produced by all differences of texture, all

diversities of substance, all inequalities of temperature, all complications of circumstances. I connect an abstract antecedent with an abstract consequent, and I connect them as Mill himself shows, by subtractions, suppressions, eliminations. I expel from the two groups which contain them all adjacent circumstances; I discover the couple under the surroundings which obscure it; I detach, by a series of comparisons and experiments, all the subsidiary accidental circumstances which are found accompanying it, and finish by laying it bare. I appear to be considering twenty different cases, and in reality I consider one only. I appear to proceed by addition, and in reality am performing subtraction. All the methods of Induction, then, are methods of Abstraction, and all the work of Induction is the connection of abstract facts.

VII.

We see now the two great moving powers of science and the two great manifestations of nature. There are two operations—experience and abstraction; two kingdoms—that of complex facts, and that of simple elements. The first is the effect, the second the cause. The first is contained in the second, and is capable of being deduced from it as a consequent from its principle. The two are equivalent; they are one and the same thing considered under two aspects. This magnificent, moving universe—this tumultuous chaos of mutually dependent events—this incessant life, infinitely varied and multiplied, may all be reduced to certain elements, and the relations between them. All our efforts amount to the passing from one to the other, from the complex to

the simple, from facts to laws, from experiments to formulæ. And the reason of this is evident; for the fact which I perceive by sense or consciousness is but a fragment arbitrarily severed by sense or consciousness from the infinite and continuous web of being. With differently constituted senses and consciousness, other fragments would be intercepted, and it is the chance of their construction that determines what is actually perceived. They are like open compasses, capable of greater or of less extension, and the area of the circle they describe is not natural, but artificial. This, indeed, is the case in two ways, both externally and internally. For when I consider an event, I isolate it artificially from its natural surroundings, and I compose it artificially of elements which do not form a natural group. When I see a falling stone, I separate the fall from the antecedent circumstances which are really connected with it, and I put together the fall, the form, the structure, the colour, the sound, and twenty other circumstances which have really no con-

nection with it. A fact, then, is an arbitrary grouping, and at the same time an arbitrary severing ;* that is to say, an unreal group, separating things connected, and connecting things that are separate. So long, therefore, as we regard nature by simple observation, we do not see it as it is : and have but a provisional and illusory idea of it. In reality, nature is, as it were, a tapestry of which we only see the reverse, and which, therefore, we attempt to turn. We apply ourselves to discovering laws—that is to say, natural groups, really distinct from their surroundings, and composed of elements really connected. We discover couples—that is to say, real compounds and real connections. We pass from the accidental to the necessary, from the relative to the absolute, from the appearance to the reality, and, having found these first couples, we practice on them the same operation as we did on the facts, for, though in less degree, they are of the same nature. Though

* A fact, as was said to me by a man eminent in physical science, is a superposition of laws.

more abstract, they are still complex. They may be decomposed and explained. There is some ulterior reason for their existence. There is some cause or other which constructs and unites them. In their case, as in that of the facts, we can search for generating elements into which they may be resolved, and from which they may be deduced. And this operation may be continued until we arrive at elements which are entirely simple; that is to say, such that their decomposition would involve a contradiction. Whether we can find them or not, they exist; the axiom of causation would be falsified if they were wanting. There are, then, elements incapable of decomposition, and from them are derived the more general laws: from these, again, the more special laws; and from these the facts which we observe; just as in geometry there are one or two primitive notions from which the properties of lines are deduced, and from these the properties of surfaces and solids, and of all the innumerable forms which nature can produce or the mind conceive.

We can now understand the value and meaning of that axiom of causation which rules all things, and which Mill has mutilated. There is an inner constraining force which gives rise to every event, which connects everything compared and produces every actual fact. This means, on the one hand, that there is a reason for everything, that every fact has its law, that every compound may be reduced to simple elements, that every product implies factors, that every quality and every being must be derived from some superior and anterior term. And, on the other hand, it means that the product is equivalent to the factors, that the two are but one thing under different aspects, that the cause does not differ in nature from the effect, that the generating powers are nothing more than elementary properties, that the active force by which we picture Nature to our minds is nothing but the logical necessity by which the compound and the simple, the fact and the law, are transformed one into the other. Thus we determine beforehand

the limits of all science, and hold the powerful formula, which, establishing the invincible connection and spontaneous production of beings, places the moving spring of Nature, in Nature, while driving home and fixing in the heart of every living thing the iron hooks of necessity.

VIII.

Are we, then, capable of arriving at a knowledge of these first elements? For my part, I think so; and for this reason, that being abstract, they are not placed without the facts, but are comprised in them; in such a way, that all there is to do is to obtain them from the facts. Besides, as the most abstract and most general of all things, there are no facts in which they are not comprised, and from which we cannot obtain their idea. However limited our experience may be, we are able to arrive at these primary notions, and this is the point from which the modern school of German metaphysicians have started in attempting their vast constructions. They have seized on the truth that there are simple notions —that is to say, undecomposable abstract

facts—that the combinations of these engender all others, and that the laws of their union and of their mutual contrarieties are the first laws of the universe. They have attempted to attain to these ideas, and to reconstruct by pure reason the world as observation shows it us. They have broken down in their task, and their gigantic structure, all factitious and fragile, hangs in ruins, reminding one of a temporary scaffolding, serving merely to mark out the plan of a future building. The fact is, that with a high notion of our powers they have not kept in view their limits. For we are out-flanked on all sides by the infinity of time and space; we find ourselves thrown in the midst of this monstrous universe like a shell on the sea-shore, or an ant on an ant-hill. Here Mill is right. Chance is found at the end of all our knowledge, as at the commencement of all our postulates. Do what we will we can only mount up, and that by conjecture, to an initial state; but this state depends on one preceding it, which depends on another, and so on, and

thus we are obliged to accept it as a pure postulate and to give up attempting to deduce it, though we see that there is something from which it may be deduced. This is the case in all the sciences—in geology, in natural history, physics, chemistry, psychology, or history, and the primitive accidental fact extends its effects into all parts of the sphere in which it is comprised. If it had been otherwise, we should not have the same planets, the same chemical compounds, the same vegetables, the same animals, the same races of men, nor, perhaps, any one of these kinds of beings. If an ant were taken into another country, it would not see the same trees, nor insects, nor dispositions of the soil, nor changes of the atmosphere, nor, perhaps, any of these forms of being. There is, then, in every fact and in every object, a portion which is local and accidental—an immense portion—and it, like the rest, depends on primitive laws, but not directly—only through an infinite circuit of consequences, in such a way that between it and the primitive laws there is an infinite hiatus,

only to be bridged over by an infinite series of deductions.

Here, then, we have the inexplicable portion of phenomena, and this it is that German metaphysicians have attempted to explain. They have been desirous of deducing from their elementary theorems the form of the planetary system, the different laws of physics and of chemistry, the principal types of life, the progress of civilization and of human thought; they have tortured their universal formulæ with the view of deriving from them purely special cases; they have taken indirect and far-fetched consequences, as direct and intimate ones; they have omitted or suppressed the great work which is interposed between the first laws and the final consequences. They have discarded Chance from their construction as material unworthy of science, and the void so left, and but imperfectly filled up by deceptive substitutes, has brought destruction on their whole edifice.

Does this amount to saying that in the facts presented us by our little corner of the uni-

verse everything is local? By no means. If an ant were capable of making experiments, it might attain to the idea of a physical law, of a living form, of a representative sensation, of an abstract thought; for a foot of ground on which there is a thinking brain includes all these. However limited, then, be the field of the mind, it contains general facts—that is, such as are spread over vast exterior territories into which its limitation hinders it from penetrating. If the ant could reason, it might construct arithmetic, algebra, geometry, mechanics; for a movement of half an inch comprises time, space, number, force—all the materials of mathematics. So, then, however limited be the field of the mind's researches, it comprises facts which are universal—that is to say, spread over all the region of time and space. Again, if the ant were a philosopher, it might attain to the ideas of being, of nothingness, and all the stock-in-trade of metaphysics; for any phenomenon we please, internal or external, affords us these materials. So, then, however limited be the field of a mind's re-

searches, it contains absolute truths—that is to say, such as must be present in every object. And this is necessarily so ; for in proportion to the generality of a fact, the fewer are the objects which we have to examine in order to meet with it. If it is universal it is met with everywhere ; if it is absolute we cannot escape meeting it. This is why, in spite of the narrowness of our experience, metaphysics, I mean the search for primary causes, is possible, but on condition only that we remain at a great height, that we do not descend into details, that we consider only the most simple elements of being, and the most general tendencies of nature. If any one were to collect the three or four great ideas in which our sciences end, and the three or four kinds of existence which make up our universe ; if he were to compare those two strange quantities which we call duration and extension, those principal forms or determinations of quantity which we call physical laws, chemical types, and living species, and this marvellous representative power, the Mind, which, without falling into quantity,

reproduces the two others and itself; if he were to discover among these three terms—the pure quantity, the determined quantity, and the suppressed quantity*—such an order that the first must require the second, and the second the third; if he were to thus establish that the pure quantity is the necessary commencement of Nature, and that Thought is the extreme term at which Nature is wholly suspended; if, then, isolating the elements of these facts, he should show that they must combine just as they are actually combined, and not otherwise; if, in a word, he proved that there are no other elements, and can be no others, he would have sketched out a system of metaphysics without encroaching on the positive sciences, and would have attained the source without being obliged to descend to trace the various streams.

In my opinion, these two great operations, Experience, as you have described it, and Abstraction, as I have attempted to define it,

* Die aufgehobene Quantitat.

comprise in themselves all the resources of the human mind—the one in its practical, the other in its speculative direction. The first leads us to consider nature as an assemblage of facts, the other as a system of laws; the exclusive employment of the first is English, that of the second, German. If there is a place between the two nations, it is ours. We have extended the English ideas of the eighteenth century, and now, in the nineteenth, we are able to give precision to those of the Germans. Our province seems to be the restraining, correcting, and completing the two types of mind, one by the other; the combination of them into one mind; the expression of their ideas in a style generally understood, and thus to make of them the universal mind.

We went out. As always happens in such cases, each had given the other matter for reflection, neither had convinced the other. But our reflections were short; in the presence of a fine August morning, all reasonings fall to the ground. The old walls, the rain-worn stones, smiled in the rising sun. A fresh light shone on their embrasures, on the keystones of the cloisters, and the glittering leaves of the ivy. Roses and honeysuckle climbed the walls, and their flowers sparkled as they trembled in the light breeze. The fountains murmured in the lonely courts. The charming city stood out from the morning mist as beautiful and peaceful as a fairy palace, while its robe of rose-coloured vapour was indented, as embroidery of the renaissance, by a bordering of

towers, cloisters, and palaces, each enclosed in verdure and decked with flowers. The architecture of different times had mixed there ogives, trefoils, statues, and columns; time had softened their several tints, the sun united them in its light, and the ancient city seemed a shrine to which every age and every genius had in its turn added a jewel. Beyond this, the river rolled a sheet of silver, and mowers stood to the knee in the high grass of the meadows. Myriads of buttercups and meadow-sweet, grasses bending under the weight of their grey heads steeped in dew, swarmed in the rich soil. Words cannot paint this freshness of tint and luxuriance of vegetation. As the line of shade retreated the flowers appeared brilliant with life. On seeing them, virgin and timid in their gilded veil, one thought of the blushing cheeks and modest eyes of a young girl who puts on for the first time her jewelled necklace. Around, as though to guard them, enormous trees, four centuries old, extended in regular lines, and in them I found a new trace of that practical good

sense which has accomplished revolutions without committing ravages; which, while reforming in all directions, has destroyed nothing; which has preserved both its constitution and its trees; which has lopped away dead branches without injuring the trunk; and to which it is owing, that this alone among the nations is in the enjoyment not only of the present but of the past.

THE END.

LONDON:
STEVENS AND RICHARDSON, PRINTERS, 5, GREAT QUEEN STREET, W.C.