The True Theory of Induction. By the Rev. W. G. DAVIES, B.D., Rector of Llansantffraed, Abergavenny, late Chaplain of the Joint Counties' Asylum, Abergavenny.

(*Concluded from Vol. xxxiii, p.* 229.)

Having thus pointed out the difference between the singular and the general relative to the Law of Similarity, we may understand with greater clearness how Induction, though coming in common with every other mental process under this same law, nevertheless at the outset, namely, in the whole of comprehension, is never concerned with the comparison of similars, that is, two or more individual chains of identity, and cannot therefore, in its origin, be generalization from experience.

"Why," asks J. S. Mill, "Why is a single instance, in some cases, sufficient for a complete induction, while in others myriads of concurring instances without a single exception known or presumed goes such a little way towards establishing a universal proposition?"* Mill here caught sight of some of the outlying islands, but did not succeed in piercing the gloom that hid the mainland from his view. As a reply to Mill's question, we hold that unless an induction can be shown to be formally valid in a *single* instance no number of similar instances will avail to insure its validity. We cannot multiply 0 into 1. How do we know, man, woman, and child, that we are necessarily supported by the floor under our feet? How do we know that this bust depends on the pedestal for support? We see that the bust is placed upon the pedestal—this is direct perception; but the pedestal gets moved out of its erect or proper position, and the bust falls —this, too, is direct perception. Now from these two data the conclusion is forced upon us that the bust must have depended on the pedestal for support, a fact which we now know at first-hand, that is inductively. Previously we knew it at second-hand as a deduction from kindred instances which we had established by implicit Induction.

5. The Canon of Induction which has now been described is, we submit, one of the most, if not *the* most, important of the Laws of Thought. For to it are to be traced the origin of such weighty notions as Essence, Dependence, and Causa-

* "Logic," People's Edition, p. 206. "Whoever," continues Mill, "can answer this question knows more of the philosophy of logic than the wisest of the ancients, and has solved the problem of Induction."

tion. The Laws of Identity, Contradiction, and Excluded Middle pale in importance before it, while, indeed, as laws, they are beholden to it for that high position.

J. S. Mill maintains that "the notion of Cause is the root of the whole theory of Induction."* This view, to our thinking, involves a clear ὕστερον πρότερον, for without Induction we should not have the faintest notion of Causation, that is necessary connection between an antecedent and a consequent, which, to us, is the only intelligible notion of cause—not invariability of succession, not power, force, or will—for without Induction there would be nothing to reveal the secret relation in which antecedents stand to the consequent. To *direct* perception there is nothing presented in Causation but successive phenomena, a fact which the *à posteriori* school have not been remiss in forcing upon our notice. The place which Mill assigns to the Law of Causation we assign to the Law of Necessary Connection, which embraces the former. But the existence of Necessary Connection, and the uniformity with which it prevails in Nature, are learnt exclusively by Inductions. This uniformity, however, does not help to constitute the validity of the Inductions which realize it, but merely serves to exemplify the inherent validity of such Inductions. Repeating the feat of walking six miles an hour many times does not constitute the pedestrian's ability to do so, it only shows more clearly that he really possesses that ability.

The Law of Necessary Connection is not limited to the many instances in which such connection has been proved, it includes also the universalization flowing from these instances; but this universalization adds no validity to Induction; indeed, it prominently presupposes that validity. It does not provide a major premise that guarantees the soundness of the particular Inductions on which it is founded, but it does provide one that dispenses with the need of proving every particular included in that premise. It does not require a fresh Induction to prove that the Pope is mortal. That was decided long ago, when the universal proposition was inferred: "All men are mortal."

Induction is not confined to the connections that exist in the relation of succession to each other; it is equally applicable, as shown by the examples already given, to those that exist in the relation of co-existence. Let us proceed to examine these.

* "Logic," People's Edition, p. 213.

A connection is known to be necessary between co-existences, or between a Whole and its parts. To give an example as follows:—This Whole (an octagon) is possessed of eight sides. Eliminate any of these and the whole ceases to exist; therefore any of these sides is necessary to the existence of the whole. A connection is known to be contingent between a Whole and its parts; thus—A Whole, say water, is in a state of ice; melt the ice and the water remains. The connection, therefore, between water and ice is contingent only.

On this position Mansel makes the following strictures. Relative to the first example he asks:—"Does this mean exist in fact or in thought? A man cannot exist in fact without his head,* but we may conceive him as so existing. If it means in thought, this is a mere identical judgment. *A* is conceived as a whole made up of *b*, *c*, *d*. *A* thus means $b+c+d$, and no more. Of course *A*, as so conceived, cannot exist without *b* and *c* and *d*, because the whole is but the sum of its parts."

Answer.—Nothing exists for us but through thought, *i.e.*, consciousness. The "whole" meant, of course, is one which is not simply conceived or imagined, but one which, in the first instance, at least, has been actually perceived, and one the parts of which are not only perceived as connected with it, but, if eliminated, as destructive of it. If we perceive that the whole *A* is connected with the parts *b*, *c*, *d*, and if we also perceive that without these it ceases to exist, the whole *A* must be differently constituted from the whole *B*, which we perceive to have such parts as *x*, *y*, *z*, but which we also perceive is capable of existing apart from these latter. The principle involved in these cases may be illustrated by this example: If a pillar be built of 50 blocks of granite, then block 50—counting from the base upward—depends on all the blocks below it, but block 1 depends on neither of the blocks above it. To limit the principle here involved to analytical judgment as a mere form of thought would be purely arbitrary. We have here, looking up the column, 49 Inductions implied, proving contingent connection among co-existences; looking down the column, 49 Inductions implied proving necessary connection. And have we not here a law shadowed forth pervading all Nature—the law that the

* We may picture him as so existing, but we cannot believe that he can live were his head cut off. We picture, in the imagination, a centaur or a mermaid, but we believe in the existence of neither.

more complex and superior necessarily depends for existence on the more simple and inferior, but not the converse. The connection between the former and all below it is necessary, whereas the connection between the latter and all above it is contingent only. The connection between animal nature and vegetable nature is necessary; the connection in the converse order is contingent. The connection between rectilineal figures and straight lines is necessary; but, conversely, the connection between straight lines and rectilineal figures is contingent only.*

We have next to examine, more closely, necessary connection and contingent among unit cases of antecedence and consequence. These kinds of connection are known thus :—When this event follows that concurrence of events, and cannot follow without the antecedence of that concurrence, then this event follows necessarily from the antecedence of that concurrence. But if this event follows that concurrence of events, and happens when that concurrence has no connection with it, then this event only contingently follows that concurrence. Criticizing this position, Mansel observes :—

"This is physical necessity only, *e.g.*, a certain conjunction of the moon and sun is necessary to an eclipse of the latter; but we may conceive an eclipse caused by other means, or we may conceive the moon's shadow as transparent, and the sun shining through it."

Answer.—It is beyond our power to conceive an eclipse of the sun, such as now takes place, caused by other means. For it is evident that exact reproductions of an individual event involve exact reproductions of its antecedents. Because an individual or singular instance of causation cannot occur if any of the elements that are essential to it be eliminated. When causation comes to be considered as a general fact it

* To guard against a misunderstanding of the statement made in the text it has to be borne in mind that, in necessary connection, as that between block 50 and those below it, there is a relation between two things, and since the conception of one term of a relation involves that of the other, then, if an instance of necessary connection be expressed in a proposition, as, for instance, "Block 50 is necessarily sustained in its position by the blocks below it," conversely, "the blocks below must be sustaining block 50;" if "*A* causes *B*," conversely, "*B* must be caused by *A*." But, on the other hand, *i.e.*, as set forth in the text, while block 50 could not maintain its position were the other blocks removed, they can maintain their position though block 50 were hurled to the ground. Animal nature presupposes vegetable nature, and whenever this relation exists *in fact*, conversely, vegetable nature must be presupposed by animal nature. But while, to animal nature, this relation is a *sine qua non*, to vegetable nature it is simply an *addendum*, for it may, and does, exist without sustaining animals in many and many an instance.

will be necessary to bear this in mind, and to distinguish carefully between elimination as here pointed out and abstraction for the purpose of forming a general notion of any cause.

Instances of causation, in so far as they resemble each other, are reducible into classes, and some qualities that are indispensable to individual instances of causation are then bound to be regarded as contingent to the factitious general whole which is thus formed. For example, suppose that a certain death is caused by stabbing, with a certain instrument, by a certain person, in a certain vital part of the body. Now to this individual case of death every one of the particulars here named is necessary. But if we form a general notion of death by stabbing we are by that act constrained to relegate to the category of accidents the notion of a certain instrument, by a certain person, and a certain vital part of the body. Of a class of events thus formed we can only declare that it will have a certain class of antecedents. Having formed a general notion of the events by overlooking their points of difference, we must also form a general notion of their antecedents by a similar disregard of differences.

That inductive law holds good in the case of geometrical truths is strikingly evident. Within our experience two straight lines never enclose a space—positive percept; if such lines be made to enclose a space, one of them at least must cease to be straight—negative percept; therefore, two straight lines cannot enclose a space. Now, when we say that an infinite number of two straight lines of any length, or a single pair of straight lines produced to infinity, can never enclose a space, we mean exact reproductions of the two straight lines which Induction proves to be essentially incapable of enclosing a space. A universal truth must have a model or *principium* established in accordance with the Canon of Induction for its basis, and every *principium* so obtained, whether in arithmetic, geometry, chemistry, &c., is of one and the same type, and cannot be negatived without committing a *subversio principii;* hence the Universal.

6.—The formula of inductive reasoning herein presented involves certain rules. Of these we shall at present mention two only, the chief rules of Induction, the one primary or fundamental, the other secondary or derived.

Rule 1.—The positive and negative premise of an Induction must be compared, the one with the other, through *one* medium.

Rule 2.—The next approach to one medium is when the premises are compared, the one with the other, through two media which exactly resemble each other.

Example: In this case A is connected with B; in that other case if you eliminate A you eliminate B; the two media are exactly similar, therefore it is proximately inferred that A is necessary to B.*

As correct Inductions in compliance with Rule 1, let us select the following:—These two straight lines do not enclose a space; if they are made to do so one of them at least must cease to be straight, therefore these two straight lines cannot enclose a space.

This animal life is sustained by organic substances; this animal life, if deprived of these, becomes extinct; this animal life, therefore, necessarily depends for subsistence upon organic substances.

To these Inductions Mansel raises the following objections:—"These two straight lines are two given lines of a fixed length, and, as seems from the argument, sufficiently material to admit of bending. The argument does not come up to the axiom which says that two straight lines, if produced to infinity, *i.e.*, to any length beyond the length of these, can never enclose space."

Answer.—"These two straight lines are two given lines of a fixed length." Certainly. They are the *principium, i.e.*, the two straight lines that have been proved by Induction to be incapable of enclosing a space. Now, the axiom is arrived at by Universalization from such Inductions, and that in countless instances, for it is the peculiarity of most necessary connections of this sort that our experience spontaneously affords unceasing examples of them.

"Examples 1 and 2," argues Mansel, "are not parallel cases. We can conceive animal life continued without organic substances. We cannot conceive two straight lines enclosing space. Why this difference if both are instances of similar inductions?"

* A remarkable violation of Rule 2 has lately come to our notice. Mr. C. S. Read, at a late meeting of the Farmers' Club, declared "That in Norfolk recently 5 cwt. of superphosphate per acre grew 2 tons less than no manure at all." Now, unless the land manured with the superphosphate and that which "had no manure at all" were previously tested and proved to be virtually as *one*, the induction here intended is quite invalid, and proves nothing. Evidently the land that had "no manure at all" possessed, as proved by the crop, more vegetable protoplasm suitable to the same than the other land, even when manured as described.

Answer.—We mean the animal life of our inductive experience, no other; and we say confidently of that animal life, no other, that it necessarily depends upon organic substances for subsistence. This is our model produced out of the inductive mould, and out of that mould we feel confident that nothing can be produced but unvarying resemblances of the *principium.*

In Rule No. 1 a tendency which has for ages been manifesting itself seems at length to have arrived at a terminus. The explicit Induction of the ancients—the mere examination of Nature—was by Bacon, apparently taught by his legal experience, discovered to be inadequate; he plainly saw the need of supplementing the examination by a rigid cross-examination. This great step in advance has been made good, and has successfully formed the base of forward movement by subsequent inquirers. It has now been fully realized that the positive element of Induction without the negative secures no proof. These two elements, however, are not, in ultimate analysis, found to be compared through two resembling media, but in each singular instance through *one single* medium. This seems the termination, so far as the *explicit* development of Induction is concerned, of a tendency which has occupied so long a time in being finally traced. The long-explored river seems at length to have been followed up to its fountain-head in the Rule here given.

But while the author opines that he has here psychologically analyzed the inductive process to its simplest elements, he believes that behind every psychological process there is, as antecedent to it, a physiological one. Every act of knowing seems to involve an antecedent cerebral act. If, then, two objects are associated together in thought, it is because two cerebral movements are associated the one with the other. In Induction, for instance, when O (oxygen) is psychologically said to be necessary to C (combustion) there must be an antecedent physiological process of the following nature:—* Movement C is not only attended with movement O, but should there be a cessation of movement O, then movement C ceases also; movement O, therefore, is a *sine qua non* of movement C, and the reason why, in thought, a connection is found to be necessary

* Of course, our sole outlet to Being is Knowing, even as regards physiology. No Knowing, no physiology, or anything else.

between one notion and another seems to arise from the antecedent physiological law—imposed, perhaps, on the organism externally through the inlet of the senses—that movement C, for instance, cannot take place without the concomitance of movement O. On the other hand, if an object can be thought of without the concomitance of another cerebral movement, it is because such movement is not indispensable to it. The connection realized in thought, in that case, is not a necessary one, but a contingent.

In the doctrine of necessary connection here advanced it must be seen that there is not the least approach to mysticism or transcendentalism; that, indeed, it may be simply regarded as a protest against confounding two quite distinct kinds of connection, the necessary and the contingent, and, with a criminal disregard of delicate and complete analysis, treating them as if they were one.

7.—As the majority of men have arrived at the conclusion that one must belong either to the school of Aristotle, Bacon, Locke, and Mill, or to that of Plato, Descartes, Kant, and Hamilton, and some, like Buckle, with little analytic acumen and philosophical keenness of vision, gather from this that mental philosophy is an impracticable scheme, we shall here endeavour to show, by criticism of certain points in the transcendental philosophy of Kant, that the views advanced in this essay are not those maintained by the *à priori* school, because they differ in certain respects from those held by the opposite school. Our doctrine strictly conforms to the Law of Evolution. The *à priori* doctrine does not. Should we be facetiously reminded that he who sits between two stools will come to the ground, be it so; but there is this consolation—that ground sadly needed to be reached, as forming a new departure from Nature for which Philosophy has long been yearning.

According to the Kantian system, all first principles which are held to be necessary in the first degree come under the head of logical or mathematical necessity. Logical necessity is said to follow from the Laws of Identity, Contradiction, and Excluded Middle. Let us, then, proceed to examine the pretensions set up in behalf of these Laws. The Law of Identity is expressed by the formula "A is A." This is held to be a necessary and universal truth. But such truths, we have endeavoured to show, are never original, are never presentatively obtained, but conform to the Law of Evolution.

"A is A" is universalized from the inductive conclusion this "A is A," for without being A it cannot exist. The same is true of the other two laws; they are, as laws, derived from Induction.

The Kantians bring also under the head of truths necessary in the first degree the synthetical judgments of mathematics. These are said to be in necessary *matter*, and binding on the *object* of thought. Their necessity is said to arise from the fact that the matter as well as the form is supplied from within the mind. "Two straight lines cannot enclose a space"—what if the matter of this proposition should be subjective only, which we question, still, as Mansel himself teaches, conception is only possible within the limits of possible intuition, the conceived is dependent for matter upon the perceived; then, all we can know by introspection is that, as far as we have made the experiment, in thought, to follow two straight lines to any distance, they have never shown a tendency to enclose a space. But this only amounts to *inductio per enumerationem simplicem*. We must also observe that when, in thought, we make two lines enclose a space they cease to be straight, and from these data derive the conclusion which the Kantians call an *à priori* intuition. We are fully convinced, therefore, that the Kantian stronghold, the subjectivity of necessary truth in mathematics, must throw open its gates to the inductive power, and surrender its mystical pretensions. Its feudal stronghold must become a thing of the past.

8.—On the whole scope of our theory, our illustrious critic, in the correspondence which passed between us, remarks:—"No theory of Induction from facts perceived *ab extra* with which I am acquainted has ever succeeded in explaining the fact, which, as a fact, must be explained and not ignored, that I can conceive, in another world, the reversal of the most established physical law, but I cannot conceive the reversal of a mathematical truth. Mr. Mill, in his desire to put mathematical truths on the same level as physical, holds it conceivable that, in another world, 2 + 2 may make 5. This is the legitimate consequence of his theory; but so far as my own consciousness can be trusted, I am unable to conceive, or imagine, or suppose, anything of the kind."

Answer.—Those who, in opposition to the views of inquirers like J. S. Mill, uphold the *à priori* doctrine, we look upon as asserting the force of that inductive process which implicitly

operates in all sound minds as the chief act of reasoning, and which only attains the explicit stage after ages of inductive research, and then only by the *one* form being detected in the *multiform* matter of inductive science, in which, for a long time, it lurks in the engaged state, like morphia in crude opium. We are quite as unable as our critic to conceive, imagine, or suppose 2+2 making 5 in some other world than this, but the inability arises, in our case, from the consciousness of its anti-inductive character, from its being felt to be a gross *subversio principii*.

"Now I will suppose," continues our revered critic, "two bottles, one having a pure acid in it, the other a pure alkali. The mixture will be, according to chemical law, a given neutral salt. But I can perfectly imagine the first instance out of the two bottles resembling a neutral salt, and the second mixture, out of the very same two bottles, of the same ingredients, in the same quantities, resembling a glass of port wine, or even a cup of tea. I do not say that I believe* this, but I can conceive* it taking place; but I cannot conceive 2+2 making 4 to-day and 5 to-morrow, or making 4 here and 5 in the dog star. This is the difference which I think your theory does not explain. Or, to put the case in a different form, I do believe that Omnipotence can create a world in which the very same ingredients which now produce a neutral salt shall produce something totally different, but I do not believe that even Omnipotence can create a world in which 2 and 2 shall make 5. Why this difference?"

Our esteemed critic has started here a question which without doubt is a formidable one, and one that demands a serious answer. We beg to suggest the following explanation:—The difference appears to us to arise from the great complexity of the chemical as compared with the arithmetical truth. The former is more advanced in the order of evolution. We see at a glance that 1+1 admits of but one combination, but if we go on greatly increasing the number of units, the possible combinations become so many as to

* We think it would conduce much to clearness were the term "inconceivable" confined to what cannot be realized as a conception, or picture or image, namely, that which a term expresses; and that the term "unbelievable" should be used of propositions that assert what is in opposition to beliefs either direct or indirect, *i.e.*, reasoned. The term "conception" would then have as its related adjectives conceivable and inconceivable, and the term "belief" (judgment) believable and unbelievable.

grow quite bewildering. Now the arithmetical and geometrical examples usually selected as instances of necessary connection are of such a simple nature that the combinations of which they are capable are easily perceived at once, and their negation is instantly barred by the impossibility of conceiving or framing a mental picture, of any one of them, say of a bilateral figure. But when we have to deal with highly complex combinations, so many variations, as Mansel argues, are found to be conceivable, that it is only by the help of explicit Induction we become able to decide which is the real combination and which are the unreal ones. Without such a criterion operating, either in its implicit, semi-implicit, or in its explicit stage, science would be impossible. That would be the very opposite of water, as made known to us, which may be supposed to be made solid by heat and evaporated by cold, and to call such an object water would be a flagrant violation of the laws of naming. If, in the teeth of the Induction which proves the contrary, we endeavour to think of petroleum as extinguishing fire, we are, in reality, thinking neither of petroleum nor of fire, but of something so different from either that it is an outrageous proceeding to apply these names to them. The 5 which J. S. Mill unaccountably supposes 2+2 may make in some other world than this is, in like manner, so different from our 5 that to give it the same name is as gross an abuse of language as calling a circus-clown a bishop. Let us select for experiment the following false propositions :—A chiliagon is a figure having nine hundred and ninety-nine sides; any two sides of a triangle are together equal to the third; a triangle is a four-sided figure; 1+1 equals 3. Now these are simply *verbal* assertions : it is impossible to frame a *mental* assertion answering to either of them. But why are we instantaneously startled by the contradictory character of the two latter, but have to ponder, perhaps, before we realize the contradictory character of the two former? Why is this? The principle involved is precisely the same in each of these instances. An untutored mind may think that a parabolic curve, if carried to a great length, may become a straight line, and yet cannot believe that 2+2 equals 5. Why is this? The difference existing among cases of this sort evidently consists not in kind, but in the great complexity of the one as compared with the great simplicity of the other.

The connections which, of all others, Induction most clearly reveals as necessary are those that pertain to the elementary truths of mathematics. These the transcendentalists have long been in the practice of regarding as their home dominion, accounting for their origin by what they call *à priori* intuition. But this theory, conceived at a period when the method of inquiry concerned in the construction of the physical sciences was but slightly developed, amounts simply to a declaration of common sense, an irresistible feeling that something, one knows not what, reveals necessity as pertaining to the connections mentioned. Now, since Induction seems so clearly to reign without a rival in these departments, can we avoid the conclusion that its dominion is co-extensive with all science, all philosophy?

One great point which this essay seeks to establish is this: Material Induction, so called, is clearly necessitated by Laws of Thought, not based, as Hamilton contends, on Laws of Things, and, in consequence, rendered extra-logical. Indeed, since nothing exists for us but through Knowing, there can be no Laws of Things in which Laws of Thought are not implicated, for the former cannot by any possibility become known to us except through Laws of Thought, which reveal either necessary or contingent connection. Again, any instance of Singular Induction cannot be called extra-logical, because in it the conclusion is inferred *sine medio* from the premises, and also keeps strictly within the quantity of the same. Again, when such a Singular Induction, proving necessary connection, is repeated a sufficient number of times to ensure thorough accuracy, the universalization which perforce springs from it is guarded from logical flaw by the fact that whenever an attempt is made to conceive the negation of the same, an anti-inductive act, a *subversio principii*, is involved. This, to our thinking, renders the universalization completely intra-logical, a conclusion deriving strong confirmation from the fact that "a necessary truth" has always been regarded as, virtually, a universal truth.

We would briefly reiterate, relative to necessary connection, that what the Kantians call *à priori* intuitions; J. S. Mill, beliefs rendered irresistible by insuperable association begotten not only by invariable, but unconditional uniformity, but receiving no confirmation from the inconceivableness of

their negation; Herbert Spencer, beliefs discovered by the inconceivableness of their negation to be both irresistible and indestructible—we call beliefs established by Induction, beliefs the negation of which is unbelievable because anti-inductive, because involving a *subversio principii.*

In conclusion, we desire to profess our firm belief in the universality of the Law of Evolution. We are constrained to hold that man's physical and organic antecedents, existing as they do prior to man himself, determine his constitution, that is, cause his nature to conform, as its development proceeds step by step, to their inexorable conditions. Notwithstanding the divergence between his views and those of J. S. Mill, the author, in common with him, believes "The state of the universe at any one instant to be the consequence of its state at the previous instant, inasmuch that one who knew all the agents which exist at the present moment, their collocation in space, and all their properties—in other words, the law of their agency—could predict the whole subsequent history of the universe."* It is because there are necessary connections in Nature (*sic* Knowing—only source of evidence) that the mind has been moulded so as to reveal them to us in Induction, and to distinguish between them and contingent connections. But while convinced that the Law of Evolution thus conditions the mind, we must not, with Comte, vainly strive to shut our eyes to the ever-present fact that, without Knowing, all is to us a blank. If, then, the point of departure in Evolution is from the pole of simplicity, man's departure, without doubt, is from the reflex operation of Knowing evolution's highest height; or, as the same law has been set down in Logic long ago—extension, the pole of which is the *summum genus*, the One in many, bears an inverse proportion to intention, the pole of which is the individual, the many in One, specially the microcosmic individual unity—a Man.

* "Logic," People's Edition, p. 226.