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I.

THE COMPARATIVE CERTAINTY OF PHYSICS AND METAPHYSICS.

THEOPHRASTUS, or perhaps Andronicus, in editing the writings of Aristotle, arranged them in two classes: *τὰ φυσικά* and *τὰ μετὰ τὰ φυσικά*: physics and metaphysics. Whether the meaning was, that the latter class is to be *read after* the first, or whether it treats of objects that *exist beyond* those treated of in the first class, has been disputed. We shall adopt the latter explanation as much the most probable, and understand by physics those provinces of inquiry which relate to the irrational and material world, and by metaphysics those relating to the rational and spiritual. Aristotle's own division of knowledge favors this explanation of the running titles under which his writings have been placed. "If there is something," he says, Metaphysics, v. i., "that is eternal and immovable, and that involves a separate subsistence, it is evident that it is the province of ontological science to investigate this. It is not certainly the province of physical science, for physical science is conversant about certain movable natures." Under *τὰ φυσικά*, Aristotle included the doctrine of material motion as seen in the heavens and earth; the history of animals; the nature of sensuous perception; of memory; of sleep and dreams; of life and death. Under *τὰ μετά τὰ φυσικά*, he grouped ethics, politics, rhetoric, logic, and ontology or metaphysics proper. Some of these terms were wider than in modern usage. This is particularly the case with ethics and politics, which included considerable that now falls under the heads of psychology and philosophy. Aristotle regarded the metaphysical division as by far the most important part of human knowledge, denominating it the "first philosophy," implying that the physical division is secondary.

Speaking generally, knowledge is the cognition of entity. Non-entity cannot be the subject-matter of human investigation. A substance, or real being of some kind, is requisite in order to actual knowledge. An exception to this seems to be found in logic and mathematics. Logic is concerned not with real objects, but with the laws of thinking; and mathematics is occupied with numbers, proportions, points, lines, and surfaces, which have no objective existence, being neither material nor spiritual substance. But, strictly speaking, logic and mathematics are not knowledge itself, but only the organs or instruments of knowledge. They are only auxiliar to the cognition of real being, and hence are denominated *formal* and not real sciences.

If, then, knowledge is the cognition of actual objects, it is clear that the dignity and worth of any science depends upon the dignity and worth of the particular object which it endeavors to comprehend. The science of meteors is not so important as the science of man. Whether physics is higher in the scale than metaphysics must be determined by the nature and properties of the subject-matter of each. For, assuming that there are substances of two kinds that present themselves to the human intellect for investigation and cognition, namely, matter and mind, it is evident that the sciences which severally rest upon them will be marked by peculiarities derived from each separately. Knowledge that has physical substance and its properties for its foundation, will differ from knowledge that has spiritual substance and its properties for its basis.

One of the most important characteristics of knowledge is its validity and certainty. In arranging the order of excellence and superiority among human sciences, those are placed in the forefront which are most absolute and certain in their statements and proportions. This excellence has been claimed for physics by one party, and for metaphysics by another. The history of opinions is to a considerable degree the account of the struggle between the two. Plato in the Sophist (246) describes the conflict going on in his day as like that between the giants and gods:

"Some of them are dragging down all things from heaven, and from the unseen, to earth, and seem determined to grasp in their hands, rocks and oaks; of these they lay hold, and are obstinate in maintaining that only the things which can be touched and handled are being or essence, because they define being and body as one; and if any one says that what is not a body exists, they altogether despise him, and will hear of nothing but body. And that is the reason why their opponents cautiously defend themselves from above, out of an unseen world, mightily contending that true essence consists of certain intelligible and incorporeal ideas; the bodies of the materialists which are maintained by them to be the very truth, they break up into little bits by their arguments, and affirm them to be generation and not essence. O Theatetus

there is an endless war which is always raging between these two armies on this ground."

Owing to the uncommon absorption of the inquirer of the present day in physical objects and problems, this generation has seen more of the contest than some others, and is more divided in sentiment upon the point, than has sometimes been the case. The postulate of the Greek Sophist, that nothing is real but material substance, lies under considerable of the current thinking. Entire sciences which have engrossed the strongest minds, and yielded the finest intellectual products, are thrown out of the catalogue as unscientific. The assertion of Comte that the science of matter and nature alone is certain, and his denial that the science of mind and of God is science at all, is credited by many. It is, therefore, seasonable to inquire whether this is so; and we purpose to examine *the comparative validity and certainty of physics and metaphysics.*

It is clear that no science can be any more *a priori* and necessary than the subject-matter of the science. If an edifice rests upon the solid ground, it must be stationary; if it rests upon the waves, it must fluctuate. An *a priori* science, like geometry, retracts no positions, and is immutable, because it deals with mental axioms and the logical conclusions from them. An *a posteriori* science, like geology, is continually changing its position, because it derives its data from the notices of the senses, and new notices show that old deductions were errors. Whether, therefore, the science of physical nature and matter is as necessary and immutable as the science of God and the human mind, will depend upon whether nature and matter are as necessary and immutable in their properties and structure as God and the rational soul of man. Let us compare the two.

If there be anything fixed and uniform in the material world, it is the *laws* and *forces* that prevail there. These are sometimes denominated the necessary laws of matter. But when examined, the necessity of material laws is found to be only relative. They are necessary under the present arrangement, and in the existing system. Had the constitution of the material universe been different, they would have been different. There is no contradiction in the supposition that there might be a different system of nature from the present one; that matter might have different properties from what it now has; and that natural laws might be other than they are. There is no avoiding this, unless the position of the eternity of matter is adopted. In this case, the properties and laws of matter have absolute and not relative necessity. But if we take the position of the theist, and concede that matter with its properties and laws was

created *ex nihilo* by omnipotent power, then we can conceive, without any self-contradiction, that the Creator could have constituted the material world upon a law of attraction operating inversely as the cube of the distance, as easily as He has made it upon the existing law operating inversely as the square. If He could not, then He is conditioned. There is something in the nature of matter, and out of Himself, such as was supposed in the Platonic ὕλη, which compels Him to form and establish the material universe in the manner He has. There is an insuperable limit set by nature and matter to the divine power, so that God is powerless in any other direction than the one actually taken. He is merely a Gnostic demiurge, and not a Biblical creator.

The same is true of vegetable and animal types and forms. Granting that they are creations *ex nihilo*, there is nothing to prevent the supposition that they might have been made upon a plan very different from the one actually employed by the Creator. It is absurd to suppose that the Omnipotent has exhausted His power in the existing universe, or that the Omniscient can have only one scheme within His ken.

These views of the sovereignty of God over the properties and laws of matter, and of His free power to constitute the system of nature differently from what He has, are adopted by leading minds in physical science. Newton, at the close of his Optics, remarks that "the motions of the planets are marked by certain small irregularities which appear to come from the mutual action of the planets and comets, and which will probably become greater and greater in the course of time, until at last the system will again require its Author to put it in order."

Leibnitz thus speaks concerning the laws of motion:

"The laws of motion which are operative in nature, and are verified by experience and observation, are not absolutely demonstrable like a geometrical proportion. They do not spring from a principle of necessity, but from a principle of perfection and order; they are an effect of the will (choix) and wisdom of God. Hence, these laws are a wonderful proof of the existence of an intelligent and free Being, in opposition to the system of absolute and unreasoning (brut) necessity taught by Strato and Spinoza." (Leibnitz's "Theodicée," Partie ii. § 345. Ed. Erdmann, p. 604).

In a similar manner, Whewell remarks that

—"the force of gravity might, so far as we can judge, have been different from what it now is. It depends upon the mass of the earth; and this mass is one of the elements of the solar system which is not determined by any cosmical necessity of which we are aware. We cannot see anything which would have prevented either the size or the density of the earth from being different, to a very great extent, from what they are. We can very easily conceive the solar system so adjusted that the year should be longer

or shorter than it actually is. If the earth were removed toward the solar centre by about one-eighth of its distance, the year would be diminished by about a month."

After saying that the vegetable world has been adjusted to the year as it now is, Whewell adds that the length of either the solar or the vegetable year "might have been different from what it is, according to any grounds of necessity which we can perceive." Only, if one were altered, the other would be adjusted accordingly (Whewell's "Astronomy and General Physics," B. 1, Ch. i. iii.)

Statements to the same effect are made by a writer in the London *Quarterly Review* for July, 1876:

"The law of the inverse square is but the mathematical expression of a property which has been imposed on matter from the creation. It is no inherent quality, so far as we know. It is quite conceivable that the central law might have been different from what it is. There is no reason why the mathematical law should be what it is, except the will of the Being who imposed the law. Any other proportion would equally well be expressed mathematically, and its results calculated. As an instance of what would occur if any other proportion than the inverse square were substituted as the attractive force of gravity, suppose at distances 1, 2, 3, the attractive force had varied as 1, 2, 3, instead of the squares of these numbers. Under such a law, any number of planets might revolve in the most regular and orderly manner. But under this law, the weight of bodies at the earth's surface would cease to exist; nothing would fall or weigh downwards. The greater action of the distant sun and planets would exactly neutralize the attractive force of the earth. A ball thrown from the hand, however gently, would immediately become a satellite of the earth, and would for the future accompany its course, revolving about it for the space of one year. All terrestrial things would obey the general law of the system, but would acknowledge no particular relation to the earth."

If these positions of Newton, Leibnitz, and Whewell are correct, it follows that absolute certainty cannot characterize physical science, because the subject-matter of cognition within this domain is not *a priori* and necessary. Since physical substance and its laws might have been different, or might not have been at all, the knowledge of them is the knowledge of the relative, the conditioned, and the mutable. When the subject-matter of a science has an *a priori* necessity, cognition in this province acquires absolute certainty from the subject-matter. This is the case with geometry. The data here are the intuitions of the mind, and the necessary conclusions from them. Geometry does not deal with material substance and its phenomena, but with ideal points, lines, and surfaces. It is absolutely necessary that the radii of a circle should be equal, but not that there should be a circular body like the sun. The laws of matter are not derived intuitively from the mind, like geometrical axioms, and then attributed to matter, but they are derived from matter and then impressed upon the mind. Physical laws, as formulated, are deduced from the outer world, and have only relative necessity and certainty,

because this world has only such. Axioms, on the contrary, are derived from the mind itself, and have a kind of certainty that cannot attach to a generalization drawn from the observation of material phenomena. Chemistry is uncertain respecting the number of indecomposable substances. Forty years ago, the chemist asserted that there are fifty simple substances. The chemist of to-day gives a list of sixty-three ("Unseen Universe," p. 121). These sixty-three may, possibly, ultimately be reduced to a single one, and physical science is striving for this. But there is no certainty in the case. It may be that there are one hundred and sixty-three simple substances in the entire physical universe, of which such an infinitely small part has been examined by the chemist.

Passing, now, from physics to metaphysics, let us consider the nature of the entity that is cognized here. Mind and its phenomena is the subject-matter of metaphysical investigations. Unextended, incorporeal, spiritual substance is the reality in this instance. But mind is reason, and reason is marked by immutable and necessary properties. It differs from matter in this respect. Matter, conceivably, may be of an indefinite variety; but we can conceive of only one species of reason. When God creates a rational being, He makes him after His own image; but when He creates a physical substance, He does not create it after His own image, but as He pleases. This makes reason one and invariable in its essential properties, while matter is variable. We cannot conceive of God's creating two diverse sorts of rational mind, but we can conceive of His creating a hundred different sorts of matter. All finite reason must resemble the Infinite Reason in kind. When God creates a rational spirit, He must, from the nature of the case, make it after His own likeness, and after no other pattern. But when He creates physical substance He is not thus restricted. Matter, unlike mind, has no eternal archetype in the Divine Nature. God is immaterial, a pure spirit without body, parts, or passions; and therefore when He creates physical substance He creates something that has no resemblance whatever to Himself. Matter, consequently, has nothing *a priori*, or intrinsically necessary, in its properties. Not being made after any original and eternal pattern drawn from the Divine Essence, it may be made, as God pleases, in an indefinite number of modes. But when finite mind and reason are created, they are made after the Divine image, and therefore can be of only one species and quality.

Accordingly, the *laws* of mind have more of necessity in them than the laws of material nature have. The laws of thought as enunciated in logic are more immutable than physical laws. Logic is *a*

priori in its regulative principles. Mathematics is necessary and absolute in its axioms and conclusions. We cannot conceive of a different species of logic or mathematics; but we can conceive of a different astronomy, chemistry, and geology—a different physics generally. The movements of the planets might, conceivably, have been different, but the movement of the human intellect in logical or mathematical processes could not have been otherwise.

This is true also of *moral* law, as well as of mental. When we pass from the world of physics to the world of ethics, and examine the laws that rule and regulate in this realm, we find more than a relative necessity. Take the decalogue as summed up by our Lord: "Thou shalt love the Lord thy God with all thy heart, and thy neighbor as thyself." This is for the rational universe what the law of gravitation is for the physical. And it is necessary and absolute for all intelligences. We cannot conceive that it might have been different from what it is: that the command might have run thus: "Thou shalt hate the Lord thy God, and thy neighbor." Neither can we conceive of such a modification of it as to allow an equal degree of love toward the Creator and the creature. The golden rule, "Whatsoever ye would that men should do to you, do ye even so to them," is absolutely necessary. Neither the contrary, nor any modification of it, is conceivable. No other rule for the conduct of finite rational beings could have been laid down by the Supreme Reason.

Testing, then, the entity, or substance, which is the object of cognition in physics and metaphysics respectively, by the *properties* and *laws* belonging to each, it is clear that absoluteness and certainty are to be ascribed to the latter, and not to the former. We now proceed to adduce still further proof of the comparative uncertainty of the former.

Physical science is uncertain knowledge because it is to a great extent empirical, or experimental. It is founded upon the observations of the five senses. But the senses never teach any *a priori* and necessary truth. They show what may be, and what actually is, but not what must be. They disclose what occurs under certain circumstances, but not under all circumstances. By the senses, we know as a present fact that the sun rises in the east once in every twenty-four hours; but the senses do not teach that this could not possibly be otherwise, and that the sun must of necessity rise in the east from eternity to eternity. Says Hume:

"The contrary of every matter of fact is still possible, because it can never imply a contradiction, and is conceived by the mind with equal facility and distinctness, as if ever so conformable to reality. That the sun will not rise to-morrow, is no less intel-

ligible a proposition, and implies no more contradiction, than the affirmation that it will rise." (Inquiry, § 5.)

Similarly, Leibnitz remarks:

"Though the senses are necessary in order to the knowledge of actual facts, yet they are not sufficient in order to knowledge of all kinds; since the senses give only present examples and instances, and teach only particular and individual truths. No matter how great the number of examples may be that establish a particular truth, they are insufficient to demonstrate the universal necessity of this truth; because, it does not follow that since a thing has uniformly occurred up to this moment, it will continue to occur forever. The Greeks and Romans noticed that in twenty-four hours, day uniformly turned into night, and night into day. But they would have erred, had they concluded that this fact is necessary and universal; since it is not a fact in Nova-Zembla. And it would be a yet more mistaken judgment to conclude that this alternation of day and night is absolutely necessary at least within the temperate zone; because it is possible for both the earth and the sun to cease to exist." ("Nouveaux Essais, Avant-propos.")

Again, the judgments of the senses are variable and uncertain, from the very nature of the sensuous organs themselves. Tested mathematically and absolutely no two persons see the same-sized object. The tree is taller for one man than for another. The shade of red is deeper for one eye than for another. Pascal, perhaps the most metaphysical of mathematicians, speaking of the effect of magnifying glasses, asks:

"After all, who is to take upon himself to affirm that these glasses have really altered the natural dimensions of the objects in question; but that, on the contrary, they may not have had the effect of restoring them to their original proportions, which our eyes had altered and contracted, in the same way that is done by the action of diminishing glasses." (On the Geometrical Spirit.)

The following illustration from a treatise on Heat illustrates the uncertainty of sensuous perception. Plunge the right hand into a vessel of tepid water, and the left hand into one of iced water. Then put both into water of the ordinary temperature. The latter will now appear to be cool, if we decide according to the sensation experienced by the right hand; but warm, if we judge by the left. It thus appears that there is no difference between heat and cold when we abstract our sensations, and consider only the body which impresses us.

Thus it is evident that the sensuous data which enter so largely into natural or physical science are subjective. They depend upon the structure and condition of the organ. Size and figure are all in the eye. Sound is in the ear. If human eyes and ears had been made upon one plan, Lilliput would have been the actual world. If they had been made upon another, Brobdingnag would have been.

"Sensation," says Cudworth, "is not science or intellection, because the soul by sense doth not perceive the things themselves, or the absolute natures of them, but only

her own passions from them. Were sensation knowledge and understanding, then he that sees light and colors, and feels heat and cold, would understand light and colors, heat and cold; and the like of all sensible things. Whereas, the mind of man remaineth altogether unsatisfied concerning the nature of these corporeal things, even after the strongest sensations of them, and is but thereby awakened to a further philosophic inquiry and search about them: what this light and color, heat and cold, etc., really are; and whether they be indeed qualities in the objects themselves, or only sensations in ourselves." ("Immutable Morality," B. III., ch. iv.; "Intellectual System," B. I., ch. v., § 1).

Again, the inferences from sensible phenomena, in physical science, are uncertain because all of the phenomena have not been witnessed. The material universe is too vast for all of it to come under the notice of man's senses. Though perhaps improbable, yet it is possible that some established and accepted generalizations in the existing physics may be overthrown by future observations and new phenomena. The following facts illustrate the uncertainty of which we are speaking. Water, in cooling, contracts down to forty degrees of Fahrenheit; then, if it continues to cool, it begins to expand, and at thirty-two degrees freezes, which is very great expansion. Nature here reverses herself, and contradicts herself. The first part of her process would yield the generalization, that cold contracts substances; the second part, that cold expands substances. He who should have observed only the phenomena above forty degrees, would have deduced the general law that water *invariably* contracts in cooling; and were he of a certain school of physicists, he would add to this, that it *necessarily* contracts. If upon this planet there were no natural or artificial temperature below forty degrees, the law that cold uniformly contracts substances would be regarded as well-established and indisputable as the law of gravitation.

It is for this reason that theories in physics are so uncertain and changing. Geology furnishes abundant examples. Dr. Arnold, speaking of the discussions of the British Association in 1839, says that

"Murchison convinced Greenough and De la Beche, that they must re-color all their geological maps; for what were called the Grey Wackes of North Devon, he maintains to be equivalent to the coal formation; and the limestones on which they rest are equivalent to the old Red Sandstone, which now is to be sandstone no more, but is to be called the Devonian system." ("Arnold's Life," by Stanley, i. 142).

Agassiz, in his eulogy upon Humboldt, remarks that

"Humboldt's work upon the position of the rocks in the two hemispheres tells the history of that formation as it could be told in 1823, and is, of course, full of anachronisms."

But what absolute certainty is there that the statements of any geologist in 1881 respecting the rocks of the globe may not likewise be full of anachronisms? There would be more approach to scien

tific certainty in these empirical departments of knowledge, these subjects which depend upon tentative experiments and repeated corrections, if all the facts could be observed, or even a majority of them. But the conclusions of the physicist are drawn from only a small, oftentimes infinitesimal portion of the phenomena. Only the testimony of an eye-witness, an actual observer with instruments, is regarded as of the first rate. But how little of such testimony enters into geological theories generally. What observer was on the ground when the coal-beds were forming? We may grant that inferences that are plausible, and even probable, may be drawn from what is seen in a coal mine to-day as to what was being done in that spot ten million years ago, but absolute certainty is impossible. A convulsion by earthquake, a fusion by fire, a deposit by flood; in other words, some sudden movement in nature; might so dislocate strata, and melt up materials, and overlay with sediment, as entirely to alter a previous plan upon which nature had been working for a million of years. But the observer of the present day sees only the shattered débris, scoriæ, mud or gravel, of the earthquake, the fire, and the deluge, and knows nothing at all of that pre-existent plan which lay behind them, and was completely obliterated by them. Yet he assumes that he is beholding the very first and original plan of all, and upon the strength of what he sees at this moment lays down a theory respecting the very origin and beginning of the globe.

Theories in physics, consequently, cannot have the completeness and certainty of a theory in ethics. There is no eternal and immutable physics, as there is an eternal and immutable morality. The principles that should govern the action of all moral agents throughout the universe are necessary; but the principles that rule the material world are contingent. In this reference, the remark of Coleridge is correct:

"The use of a theory in the physical sciences, is to help the investigator to a complete view of all the hitherto discovered facts relating to the science in question. It is a collected view (θεωρία) of all he knows, in one survey. Of course, so long as any pertinent facts remain unknown, no physical theory can be exactly true, because every new fact must necessarily, to a greater or less degree, displace the relation of all the others. The only necessarily true theories are those of geometry, because in geometry all the premises are necessarily true and unalterable. But to suppose that in our present exceedingly imperfect acquaintance with the facts, any theory in chemistry or geology is completely correct, is absurd." ("Table-Talk," June 29, 1833).

The attitude, then, which Hume asserted to be the proper one toward religion, is far more appropriate in reference to science founded upon sensuous experiments and observation. "The whole subject of religion," he remarks, "is a riddle and an inexplicable mystery; doubt,

uncertainty, and suspension of judgment are the sole result of our closest examination." The way and manner in which the material universe arose from non-entity, and in which it is upheld from millennium to millennium, "is a riddle, and an inexplicable mystery" to physical science. The deep and learned minds in this province acknowledge this. To the question: "How did man originate?" Quatrefage answers: "I do not know" ("Human Species," B. I., Ch. xi.) It is impossible to explain either the origin or the perpetuity of things, by physical science:

"Where wast thou when I laid the foundations of the earth? Hast thou entered into the springs of the sea? or hast thou walked in the search of the depth? Have the gates of death been opened to thee? Hast thou perceived the breadth of the earth? Where is the way where light dwelleth? And as for darkness, where is the place thereof? Knowest thou it, because thou wast then born? or because the number of thy days is great? (Job xxxviii. 4, 16–19, 21).

Compared with the sum total of phenomena in universal space and time, only a little is known of matter and its laws, and if the claim to a *superior* knowledge is set up for natural science, then it is proper to subject it to a sceptical criticism and compel it to bring forth its proofs. Especially is this proper, when the theory is novel, and contradicts the historical theory. "I am a sceptic in physics," said a friend of ours to an enthusiastic "scientist" who was endeavoring to convince him that life is an evolution from the lifeless. Extremes produce extremes; and if the fanciful biology of Haeckel shall succeed in driving out the sober biology of Agassiz, there will be as much of scientific as there is of religious scepticism.

But scepticism, in the sense in which we are using the term, is an error both in science and religion. If anything in the great domain of material nature has been demonstrated by valid reasoning, the human mind will accept it as truth. There is much of this in the higher departments of physical science, such, for example, as astronomy. Kepler and Newton have irrefragably proved certain truths and facts within this province. Astronomy contains much of certain knowledge, because it contains much that is mathematical. "The apparent motions of the sun, moon, and stars," says Whewell, "have been more completely reduced to their causes and laws than any other class of phenomena." And it should be observed, that in this instance more has been accomplished by mental and metaphysical processes, than by sensuous and physical. Mathematical calculation has enabled the astronomer to solve astronomical problems which the senses, even aided by instruments, could not have solved. Le Verrier discovered Neptune by the calculus, and not by the naked or the armed eye.

But as we descend to lower departments in natural science, like geology for example, we find nothing of this mathematical certainty, and much doubtful theorizing built upon sensible experiments and observations. Astronomy, moreover, is a comparatively certain science, not only because it employs the calculus, but because it confines itself to *existing* facts and phenomena. Its aim is to ascertain the present structure and motions of the solar system. Geology is uncertain, because it proposes to describe a past state of things. It attempts to tell what existed millions of years ago, and even how the worlds were originally made, which involves agencies and phenomena that occurred in "the dark backward and abysm of time," and which may have been totally different from what the present phenomena and agencies would imply as interpreted by the theorist. It is worthy of notice, moreover, that astronomy, generally speaking, has been believing, while geology has frequently been sceptical. The Keplers and Newtons were reverent minds, and the main current and history of astronomical science has corroborated both natural and revealed religion. In this connection, also, it may be added, that the sceptical naturalists belong to the second and third class of investigators, and not to the first. The original and powerful intellects who discover laws, and make a positive addition to the knowledge of material nature, express their awe and worship in the language of Kepler: "Father of the universe, what moved Thee to raise a little feeble creature of earth so high as to make him a king, and almost a god, in thinking Thy thoughts after Thee? I thank Thee, Lord and Creator of all, that Thou hast filled me with rapture over the works of Thy hand, and hast enabled me to disclose to men the glory of Thy creation, so far as a finite mind can comprehend Thy infinity." Whewell accounts for this fact, in discussing the nature of Inductive and Deductive Habits of mind ("Astronomy and Physics," B. III., Ch. vi.) Investigators of the first rank, by induction discover hitherto unknown laws, and then those of the second rate by deduction draw conclusions from them, and construct schemes out of them. The original discoverer, when the law bursts upon his view, is impressed by the idea of God as the author of it. But the investigator of a secondary grade, who merely uses the discovery and applies it, is oftentimes a sceptic in regard to the Supreme Being, because he converts the law itself into a God; as the African savages worshipped the plough which produced such wonderful effects compared with their rude mattock. The inventor of the plough never would have thought of deifying it.

We come, then, to the conclusion, after this examination of the materials and subject-matter of physical and metaphysical science, re-

spectively, that in point of absolute validity and certainty, the superiority is with the latter. Tested rigorously, the sphere of natural science is a region of only relative certainty. There is nothing eternally and absolutely necessary in the laws and phenomena of matter. There is no strictly absolute knowledge within this domain, because there is no strictly absolute *object* to be known. Kant was correct in his celebrated but sometimes misapprehended position, that all cog nition within the province of the natural and the sensuous: within that region which falls to the understanding, in his nomenclature: is unaxiomatic and conditional; and that only within the domain of the spiritual and moral is there an absolutely certain intuition. What the practical reason perceives to be true, is true for all intelligence. The metaphysical ideas of God and the soul; of free will and immortality; of right and wrong, are absolute; and all science that is founded upon them is of the same nature. But physical sensations are individual, subjective, and relative. Even the conceptions of space and time are only forms of the finite understanding, under which these sensations are massed and unified. The finite mind must perceive sensible phenomena as successive in time, and its cognition of them must, consequently, always be incomplete. But the Infinite mind is untrammelled by this form of conception, and beholds all these phenomena in the simultaneous and complete intuition of omniscience. This proves that sensuous cognition under the sequences of time is relative knowledge. It is true for man, but not for God. Material and sensible things, which are the subject-matter of physics, are in continual flux. And even in regard to the invisible principles or forces beneath them; even in regard to the laws of nature themselves; we have seen that we cannot ascribe to them such a necessary and immutable quality as we must to rational and metaphysical realities. For they are creations from non-entity, and are only one out of the many various manners in which the Divine mind can express itself in a material universe. But the mental and moral universe has no such variety. Reason is one and simple; but matter is manifold and complex. The whole domain of physical nature is only a means to an end. It was created to be subservient to mind. It cannot therefore, like the domain of the moral and spiritual, which is an end in and of itself, have absolute and immutable characteristics, and therefore cannot be the object of an absolutely certain knowledge.

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