

# NATURALISTIC REASON

## TRILOGY INTRODUCTION: SCIENCE BECOMING REASON

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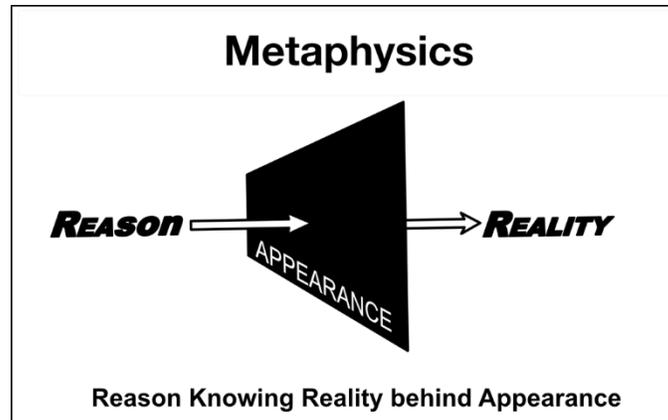
Science is our most reliable knowledge. It began in Western civilization by rejecting philosophy in favor of naturalism, and taking the existence of the natural world for granted, science used the empirical method to learn more about it. Principally, that meant going out and looking. But naturalists found a way of using the empirical method that was spectacularly successful in discovering basic regularities about change, and that inspired using the scientific method to study more specialized regularities with the expectation that they would be reduced to basic regularities. The initial success of science was announced to the world as the Newtonian revolution, and for centuries, physics was the foundation for other branches of science. However, specialized sciences have not discovered a complete explanation of them, and modern physics is baffled by what it has found at the bottom. Though naturalists expect piecemeal advances to continue, they no longer expect a science based on physics to explain how all the regularities found in the natural world are related as part of a single coherent system.

Science is, however, on the verge of fulfilling its original ambition. Physics began by rejecting metaphysical attempts in Western civilization to explain the natural world, and its success has been limited because its rejection was not complete. It continued to assume that the truth of mathematics is known independently of perception, and that has caused the intractable puzzles that keep modern physics from discovering the nature of what exists most basically. Its description of the most basic regularities is incomplete, and that has made it impossible for sciences based on physics to explain everything in the natural world. But a single discovery in physics will complete its description of basic regularities, and that will enable science to

realize its original goal. Specialized sciences will have a single unified explanation of all the regularities that were found in the study of nature.

The attainment of the original goal of science will pose a new challenge to science. It will be a kind of historical development that science cannot explain, and the challenge will be to explain its existence as part of the natural world. History traces the origin of science to Newtonian physics, and from the solutions to the puzzles of modern physics, it will be clear that mathematics was responsible for its initial astonishing success. Its assumption that mathematical truth can be known independently of perception came from metaphysics, and since metaphysics is a distinctive trait of Western civilization, science will have to explain how it could provide physics with such a powerful tool. It also depends on the single discovery that solves the puzzles of modern physics, but in a different way, and when science explains its origin in Western metaphysics, it will become Reason. But since science is a form of naturalism, the three volumes introduced here justify the prediction that science will soon become *naturalistic Reason*.

By *Reason*, I mean a cognitive power whose way of explaining what exists most basically in the natural world gives beings like us an understanding of everything that exists. Since it is complete, this knowledge is perfect. It is the wisdom to which philosophy—literally, the *love of wisdom*—has always aspired, and *Reason* is the name that philosophy gave to this cognitive power. Philosophers who defend its power to explain everything are called *metaphysicians*. Their basic claim is that Reason enables us to know *Reality behind Appearance*. (Terms essential to metaphysics are capitalized.) Reality is what really exists, and metaphysicians were able to convince themselves that Reason knows its nature because they assumed that knowledge depends on faculties of intuition. They explained perception of the natural world as *Appearance*, and explaining Reason as another faculty of intuition, metaphysicians argued that Reason enables us to know what really exists behind Appearance. I call this *intuitionistic metaphysics*. (See Figure 1.)



**Figure 1 – Metaphysics**

Intuitionists have defended the metaphysical claim to have perfect knowledge ever since ancient Greece. The history of Western philosophy is the story of arguments about metaphysics. But metaphysicians were never successful because intuitionism is false. They failed to discover what really exists behind Appearance because knowledge does not depend on faculties of intuition. To be sure, there have always been philosophers who doubt the power of Reason to know Reality behind Appearance. Their skeptical arguments have spurred new ways of defending metaphysics. But the famous philosophical skeptics were not as revolutionary as the first scientists. Though philosophical skeptics doubted the power of Reason to know Reality behind Appearance, they never doubted that knowledge of the natural world depends on a faculty of perceptual intuition. Scientists brought off a revolution by rejecting that assumption of metaphysics in favor of naturalism and taking up the empirical method.

Naturalists assume that perception is reliable knowledge about the natural world of which they are part, and using the empirical method, they infer the true as the best explanation of what they find. But the extraordinary success of physics also depended on intuitionistic metaphysics. Its success came from using mathematics as a language to describe regularities about change, and since mathematics had to be known independently of perception, physics assumed that mathematics is known by a faculty of rational intuition. That is what causes the intractable puzzles of modern physics. Thus, when physics is unified, science will have to explain why mathematics worked so well for so long as a language for describing regularities. The unification of physics will unify science, and since the puzzles of specialized sciences will have been solved, science will be able to explain how metaphysics could have provided such a language. But since metaphysics was based on intuitionism, science will have to explain the

belief in faculties of intuition, and when science discovers that explanation, it will find itself knowing Reality behind Appearance. But since it is committed to naturalism, science will become *naturalistic Reason*.

The following sections describe the argument of this trilogy more completely. But the gist can be conveyed as a biography of Reason. Reason was born in ancient Greece, and it grew up as intuitionistic metaphysics. But in the modern era, it rebelled against its metaphysical family, and taking naturalism for granted was the beginning of its adolescent identity crisis. As physics, it used mathematics to formulate laws of nature, and initially, it was successful. But it eventually encountered intractable puzzles. Nor could sciences based on physics fully explain the regularities that they found in the natural world. The resolution of its identity crisis will begin with a single discovery in physics that exposes mathematics as the cause of the puzzles it could not solve.

It is predicted in *Volume I: Unification of Physics*. That discovery about the natural world will solve all the puzzles of specialized sciences, as predicted in *Volume II: Unification of Science*. And the resolution of its identity crisis will be complete only when science discovers how such a powerful tool could have been provided by intuitionistic metaphysics. Reason will rejoin its metaphysical family and discover that it is the perfect kind of knowledge to which philosophy has aspired since ancient Greece. But since Reason's true foundation is naturalism, it becomes naturalistic Reason, as predicted in *Volume III: Unification of Science and Philosophy*. This biography of Reason turns out to be a story about inevitable changes during an inevitable stage in the evolution of life that occurs on suitable planets everywhere in the universe. On Earth, it is represented by *Western civilization*.

## **1. EMPIRICAL LAWISM**

What we call *science* began with naturalists rejecting intuitionistic metaphysics. They assumed that their animal bodies are objects located among other objects in space in a world where objects exist independently of one another. This is the *natural world*, and the assumption that it really exists is *naturalism*. Mammals can perceive the natural world, and as mammals, naturalists take it for granted that they also have a way of understanding space and what happens as objects move and interact. It is a coherent understanding of the geometrical structure of space and the passage of time, and since it turns out to be based on a faculty of imagination built into the basic structure of the mammalian brain, it is called the *faculty of naturalistic imagination*.

Naturalistic imagination enabled scientists to use the *empirical method* to learn about the natural world. Trusting perception, they went out and looked. But going out and looking was just the beginning. More could be learned by inferring what is true as the best explanation of what perception finds. The causes on which explanations depend were initially just regularities about change that are obvious in naturalistic imagination, such as effects of motion on the spatial relations of objects. But as science learned more about what happens regularly, inferences to the best explanation became more complex.

There is nothing very special about the empirical method. It is a part of commonsense with a commonsense justification. It is basically just the policy of letting the natural world itself determine our beliefs about it as much as possible. The criterion for superiority in choosing between alternative explanations of what happens is explaining more with less, and the faculty of naturalistic imagination makes such judgments possible. The goal is to explain the most with the least, and that means preferring explanations of the same regularities that depend on fewer causes over those that require more, preferring causes that explain more over those that explain less, or both. Though it is not always clear which explanation is better, it is clear enough for science to make progress.

Physics found an extraordinarily compelling way of using the empirical method, and since its success inspired the attempt to use its method to study other parts of nature, the empirical method was called the *scientific method*. The use of mathematics as a language to describe regularities about change began with Copernicus and Kepler, but Galileo and Newton made this method explicit. They discovered laws of nature, and formulating them mathematically, they could infer laws of physics as the best explanation of what happens by making careful measurements of what the laws predicted. Not only could inferior explanations be rejected, but the confirmation of physical explanations also showed that there *are* laws of physics. Precise measurements could not be predicted at all unless there were laws of physics. This is the method that Newton defended when he announced his law of gravitation and refused to make any “hypothesis” about how massive bodies exert a gravitational force at a distance. He insisted that it was enough for science to have an equation that predicts what happens, and that is what physics assumed for over three hundred years. It is aptly called *empirical lawism* because physics uses the empirical method on the assumption that the deepest possible empirical knowledge of what really exists in the natural world is knowledge of mathematically formulated laws of nature.

Though the nature of laws of physics is a contentious issue, the history of physics tells us something about it. Galileo called mathematics the *language of nature* because he believed that God used mathematics to will the laws of physics to hold when he created the natural world. Newton also attributed laws of physics to God's will. But their legacy is not theological. It is, rather, the method that made physics so successful. Newton's law of gravitation and laws of motion were formulated as equations, and in the 19<sup>th</sup> century, empirical lawism led Maxwell to formulate a set of equations that describe electromagnetic interactions. Since then, success in predicting measurements in carefully controlled conditions has discovered laws describing regularities that cannot even be understood in naturalistic imagination. Physicists are masters of mathematics, and though empirical lawism does not require physicists to explain what corresponds to their equations, they are currently baffled at what they have discovered. Their puzzles are intractable, and though physics is the basic branch of science, regularities discovered by specialized branches of science cannot be reduced to them. Modern physics does not provide the kind of explanation of everything initially expected of science.

The continuing advance of science is undeniable to anyone who considers how much technology has changed over the past century or two. That is why it is widely accepted as our most reliable knowledge. But the problems confronting physics and the other branches of science are profound and so seemingly intractable that the prediction of an imminent revolution in which they are all solved will certainly be greeted with doubt. That is, nevertheless, what I mean by *Science Becoming Reason*. And an empirical discovery can cause the revolution because it completes the rebellion of science against intuitionistic metaphysics. Physics owes its initial success in discovering the regularities described by its basic laws of nature to a treasure that it kept when it rebelled against metaphysics, and keeping it has forced science to abandon its original goal of knowing what really exists in the natural world deeply and completely as Reason was supposed to know Reality behind Appearance.

When physics rejected philosophy in favor of using the empirical method in the natural world, what ensured its success was the use of mathematics as a language to describe regularities about change. Mathematics enabled physics to describe quantitative regularities, and that tool came from the assumption in intuitionistic metaphysics that mathematics is known by a faculty of rational intuition. Instead of being inferred, like laws of nature, as the best explanation of regularities found in the natural world, mathematics was supposed to be known independently of perception.

That is something that philosophy had to offer because intuitionism is the assumption that knowledge depends on faculties of intuition. Though naturalists rejected the assumption that knowledge of the natural world depends on a faculty of perceptual intuition, they could believe that mathematics is known by a faculty of rational intuition. Empirical lawism was born of a marriage of mathematics with the empirical method, and though it was fruitful for centuries, intractable puzzles eventually accumulated in physics. Nor could the regularities studied by other branches of science be reduced to laws of physics. That is the toll that science paid for the unresolved adolescent identity crisis of Reason.

## **2. EMPIRICAL ONTOLOGY**

The solution to the intractable puzzles of physics depends on an empirical discovery. Physics has discovered enough about the natural world for it to give up the treasure that it kept from intuitionistic philosophy. The history of science is testimony to what the physicist Eugene Wigner (1959) famously called the “unreasonable effectiveness of mathematics” in discovering laws of physics. But Wigner was mistaken when he surmised that the “miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve.” It is, indeed, wonderful. And it may be undeserved, since mathematics is what Reason took with it when it rebelled against its metaphysical family and became physical science. But its appropriateness is not a miracle. Physics has learned enough about the natural world for another kind of empirical discovery to explain the *unreasonable effectiveness* of mathematics in discovering laws of physics. That is first step in physical science becoming naturalistic Reason.

Mathematics is a tool for describing quantitative regularities, and by going back to the naturalism of the pre-Socratics in ancient Greece, science can discover an explanation of its unreasonable effectiveness. The pre-Socratics set out to explain everything found in the natural world, and they assumed that there is a single cause, which they called the *archê*, or *first cause*. After generations of arguing about its nature, they concluded that the first cause is all the substances constituting the natural world. Though all the possibilities they considered can be seen as forms of materialism, they never agreed about their natures. Their seminal discovery was more basic. The pre-Socratics discovered that substances are self-subsistent entities that endure through time. Since substances do not need a deeper cause of their own

existence, they can explain the existence of what is found in the natural world. They constitute what is found, and since they have essential natures, they can explain the kinds of things found by how substances constitute them. *Ontology* is, literally, the study of existence, and thus, substances are *ontological causes*.

Since ontological causes explain *what exists*, they offer a deeper explanation of what is found in the natural world than physics. Laws of physics describe regularities about change, and since they can only explain *what happens*, they entail efficient causes. Ontological causes are deeper and more complete because substances endure through time, and they have powers by which their interactions can generate the regularities described by laws of physics on which physical efficient causes depend. The method of the pre-Socratics can be called *empirical ontology*, by contrast to *empirical lawism*, and it makes a revolution in physics possible because, if science assumes that substances are the first cause, it can discover empirically an ontological explanation of the “appropriateness of the language of mathematics for the formulation of the laws of physics.” Ontology can infer the essential natures of the substances constituting the natural world as the best explanation of the existence of quantitative regularities about change, and it can confirm this ontological explanation by describing the powers by which interactions of those substances generate the regularities described by laws of physics.

Though ontology simply assumes that there are ontological causes, physics also has a basic assumption. It simply assumes that there are laws of physics and uses them to justify the use of efficient causes to explain what happens. But empirical ontology is prior to empirical lawism. Ontological causes can explain efficient causes, while efficient causes cannot explain ontological causes. Indeed, the superficiality of physical explanations is the price that physics had to pay for the treasure it took from metaphysics. What makes the laws of physics puzzling is our inability to describe what corresponds to them in a way that we can understand in naturalistic imagination. But empirical lawism has enabled physics to discover enough about the natural world for ontology to divorce what physics has discovered from mathematics. Instead of assuming that mathematics is known *a priori*, ontology infers that the world is constituted by two opposite kinds of substances: space and matter. *Spatio-materialism* is the best ontological explanation of the unreasonable effectiveness of mathematics in discovering laws of physics because space and matter are the simplest substances whose interactions can generate only quantitative regularities. That is why the use of mathematics to formulate laws of physics was so successful. This ontological

explanation of the “appropriateness of the language of mathematics for the formulation of the laws of physics” will be confirmed empirically by identifying powers of space and matter that enable their interactions to generate all the regularities described by laws of physics. These ontological causes are called *ontological mechanisms*, and since naturalistic imagination enables us to understand the geometrical structure of space, *they* can be understood in naturalistic imagination. That is how ontology will solve the puzzles of modern physics.

This prediction is the beginning of the path that leads to the resolution of Reason’s identity crisis. *Volume I of Naturalistic Reason: Unification of Physics* shows how this discovery of about the nature of space enables empirical ontology to reduce all the laws of physics to an all-inclusive ontological mechanism called the *gravitational system*. The reduction of physics to ontology is represented by the triangle in Figure 2.



Figure 2 – natReason

The puzzles that stump specialized sciences are caused by their inability to reduce the regularities they study to laws of physics, and they are solved by the reduction of physics to ontology. It reveals a new quantitative regularity about change that entails a kind of efficient cause at work in nature that physics does not recognize. An interaction of space with matter gives matter a holistic power that is expressed as *geometrical efficient causes*, and *Volume II: Unification of Science* shows how their recognition will enable ontology to reduce the specialized regularities discovered in the study of nature to interactions of space and matter. That will explain the origin and nature of life and show that a series of inevitable stages of evolution lead to the existence of beings like us. That prediction is represented by the arrow from *Ontology* to *Science* in Figure 2.

The reduction of specialized sciences to spatio-materialism does not explain everything in the natural world because it does not explain the existence of ontological science itself. The discovery of spatio-materialism came from reducing

laws of physics to ontological causes, and since physics came from the Newtonian revolution, ontological science must explain how the treasure that Reason took from intuitionistic metaphysics could make the empirical method so powerful. That power depends on something else in the natural world. It is called *consciousness*, referring to the phenomenal aspect of experience, and ontological science can explain how it is part of the natural world. Knowing that it is a further expression of the holistic power of matter, ontological science will use consciousness as a *pseudo-efficient cause* to explain Western civilization as a distinct metaphysical stage in the evolution of life on Earth. As *Volume III: Unification of Science and Philosophy* shows, that will explain how rational intuition could be the source of the treasure that made physics so successful, and when ontological science finds itself knowing Reality behind Appearance, Reason resolves its identity crisis as science and becomes naturalistic Reason. That argument is represented by the two arrows pointing at *Philosophy* in Figure 2.

In short, *Volume I* shows how ontological causes will unify physics. Since they reveal that matter has a holistic power, *Volume II* will show how efficient causes unify science, and *Volume III* will show how a pseudo-efficient cause unifies science and philosophy. *Sections 3, 4, and 5* survey these arguments.

### **3. UNIFICATION OF PHYSICS**

Ontology solves the puzzles of modern physics by reducing them to interactions of space and matter, and it can do that because physics assumes that the deepest possible knowledge about the natural world is mathematically formulated laws of nature. Mathematics describes quantitative regularities, and physics uses mathematics like a microscope or telescope to search for laws of nature. I call it a *mathoscope* because coordinate systems are like lenses, and the equations that use coordinate systems to refer to the natural world and describe regularities about change are like images produced by focusing on them. Physics has had enormous success with its mathoscope because the regularities on which it focuses are quantitative. But if mathematics is known independently of perception, the mathoscope also represents the assumption that mathematics is true in a different way from the laws of nature that it discovers. The treasure taken from philosophy has enabled physics to discover many basic quantitative regularities in the natural world. However, there are other quantitative regularities on which mathoscopes cannot focus. As *Chapter 1* of *Volume I* shows, the use of coordinate systems to refer to the natural world would work fine if

space were just a *container* in which particles move and interact. But space is a substance that interacts with the bits of matter helping constitute the particles, and so interactions of space and matter can generate regularities that equations using coordinate systems cannot describe. Thus, intractable puzzles are caused by the assumption that mathematically formulated laws of nature are the deepest possible empirical knowledge about what really exists in the natural world. In quantum physics, the regularities on which the mathoscope cannot focus show up as the probabilistic character of its laws. In gravitational physics, the hidden regularities show up as the replacement of Newtonian absolute space and time with spacetime. And in modern physics, the difference between the mathoscopes used in quantum and gravitational physics shows up as the mathematical disparity between the two branches, which is widely recognized as the most serious problem confronting theoretical physics.

*Volume I* reduces modern physics to spatio-materialism by describing powers of space and matter that enable spatio-material interactions to generate the regularities described by the laws of modern physics. General readers can grasp how ontology solves the puzzles of modern physics because *Part One* of *Volume I* explains how interactions of space and matter generate physical regularities in a way that can be understood in naturalistic imagination. But since regularities are described by equations in physics, more detailed arguments in *Part Two* and *Part Three* show how quantitative aspects of the regularities generated by these ontological mechanisms correspond to physical equations. (In all three volumes, sections meant for general readers are printed in Serif type, like this, while technical sections meant to answer questions that those who are more familiar with the relevant fields will ask are printed in non-Serif type, like this.)

The difference between quantum and gravitational physics is, basically, the difference between regularities that hold of particles on the smallest scale and gravitational regularities that hold of matter on the largest scale. Small-scale regularities and large-scale regularities are generated by different ontological mechanisms. *Chapter 2* of *Volume I* shows how interactions of space and matter generate quantum regularities, while *Chapters 3* and *4* show how other interactions of the same two substances generate gravitational and cosmological regularities. There is no mathoscope that can focus on both kinds of regularities at once, and so there is mathematical disparity between quantum and gravitational physics. But since both kinds of regularities are generated by interactions of space and matter, the disparity

problem is solved by showing the relation between the ontological mechanisms generating them.

The ontological mechanism that explains the laws of quantum physics is the *inertial system*. It constitutes all the particles (and fields) mentioned by laws of quantum physics; it constitutes their motion in the inertial system; and it constitutes all their interactions. (Particles in the Standard Model are described by quantum field theories, and *Part Two* shows how the inertial system constitutes them.) Everything that physics calls *energy* or *mass* (or both) is a species of matter that coincides and interacts with space. But two parallel interactions between space and matter are used to constitute charged particles in the inertial system. One is the *mechanical system*, which gives particles a precise location and velocity in the inertial system, and the other is the *electromagnetic system*, whose electric and magnetic field matter mediates the forces by which charged particles interact with one another. Forces are explained according to the *fueling model*, in which a flow of (field) matter between particles mediates the interactions by which particles change one another's motion, i.e., accelerate. The mechanical system has a *quantum structure*, which explains the nature of the quantum of action (mentioned in all the laws of quantum physics). Light, or electromagnetic waves, is just field matter that has been freed from helping constitute charged particles and is carried across the electromagnetic system at the speed of light. As charged particles interact, the way that the mechanical system interacts with the electromagnetic system makes it seem that light is made up of particles called *photons*. (Similarly, bits of matter that have been freed from helping constitute charged particles and are carried across the mechanical system at the speed of light are the *neutrinos* that puzzle quantum physicists.) The inertial system explains not only the regularities described by Newton's laws of motion and the laws of electromagnetism (both Maxwell's equations and the Lorentz force law) but also the *Lorentz deformations*, which are the regularities described indirectly by Einstein's special theory of relativity.

The ontological mechanism that explains the law of gravitation in modern physics, that is, Einstein's general theory of relativity, is the *gravitational system*. The gravitational regularity cannot be explained by the inertial system because it is part of the gravitational system. The gravitational system is an ontological mechanism in which massive gravitating bodies accelerate the inertial system, giving it a velocity relative to space everywhere in the gravitational field, and that is what corresponds to the curved spacetime to which modern physics attributes gravitation. Since the

gravitational system includes its relation to the inertial system, it solves the problem of the mathematical disparity of quantum and gravitational physics. This ontological explanation of gravitation suggests an alternative to big bang cosmology, in which the expansion of spacetime is replaced by the shrinking of matter (the quantum structure of the mechanical system) in the inertial system. All the puzzles of modern physics are solved, therefore, when physics recognizes that it has been blinded by its mathoscopes, gives up empirical lawism (intuitionistic naturalism) in favor of empirical ontology (ontological naturalism), and discovers the role that space plays in helping matter generate the regularities described by the laws of physics.

The inertial system generates a regularity to which physics is blind, and that is the foundation for the arguments in *Volumes II* and *III*. This interaction of space and matter gives matter a *holistic power*, and though holism is often a rejection of reductionism, this kind of holism is reductionistic. The holistic power of matter is reduced to interactions of space and matter, and the geometrical structure of space enables spatio-material interactions to give matter a holistic power. Its expression as geometrical causes enables ontology to reduce specialized sciences to interactions of space and matter in *Volume II*, and it has a further consequence that founds the reduction of philosophy to ontology in *Volume III*.

#### **4. UNIFICATION OF SCIENCE**

The reduction of modern physics to interactions of space and matter enables *Volume II* to reduce all the specialized branches of science to them as well. These ontological reductions all depend on the geometrical expression of the holistic power of matter, that is, the recognition of *geometrical efficient causes*. Physics does not recognize them because it assumes that every event (that can be explained) depends on physical efficient causes. They are the efficient causes entailed by the basic laws of physics, and since those laws describe how particles move and interact, physical causes are assumed to explain bodies that are composed of particles interacting with one another, such as atoms and all the bodies composed of them. This physical explanation fails to recognize that matter has a holistic power that enables groups of particles that interact with one another in precise ways to move around and act on the natural world as a whole. Since these groups of particles have geometrical structures, their geometrical structures *constrain what happens by physical causes*. For example, a box can contain a gas (that is, a vast collection of molecules), a key can open a lock, and in the right environment, complex molecular machines, called *ribosomes*, can

transcribe (messenger) RNA into protein molecules. I call this the *geometrical efficient cause* because it imposes a geometrical constraint on what happens as a result of physical causes, that is, particles exerting physical forces on one another. For example, when bodies composed of different kinds of parts, such as DNA and RNA, have the same geometrical structures, the relevant constraint on what happens is the geometrical structure imposed on what happens, not the kinds of physical particles that have the structure. This is what explains the central dogma of molecular biology, which holds that geometrical structures of a DNA molecule are transcribed to mRNA and then translated into proteins. This regularity expresses the holistic power of matter, and matter would not have this geometrical power if space did not have a power to interact with matter based on its intrinsic geometrical structure. *Chapters 1 and 2 of Volume II* show, respectively, how the inertial system constitutes physical and geometrical efficient causes.

Physics assumes that geometrical efficient causes can be reduced to physical causes because the basic laws of physics do predict the energy ranges in which the geometrical structures of composite bodies are unchanged by their interaction with the rest of the world. But this robustness is an incomplete explanation of how composite bodies move and interact because the laws of quantum physics are probabilistic. Indeed, to explain atoms, physics needs a law, called the *Pauli exclusion principle*, that describes a peculiar power of particles that prevents two particles of the same kind from moving and interacting with other particles in the same way. This enables physics to predict ranges of energies in which atomic structures are stable. But even in physics, there is evidence of the holistic power of matter in puzzling quantum phenomena, such as quantum entanglement, non-locality, the interference pattern produced in the double-slit experiment, and the role of the quantum unit of action in blackbody radiation.

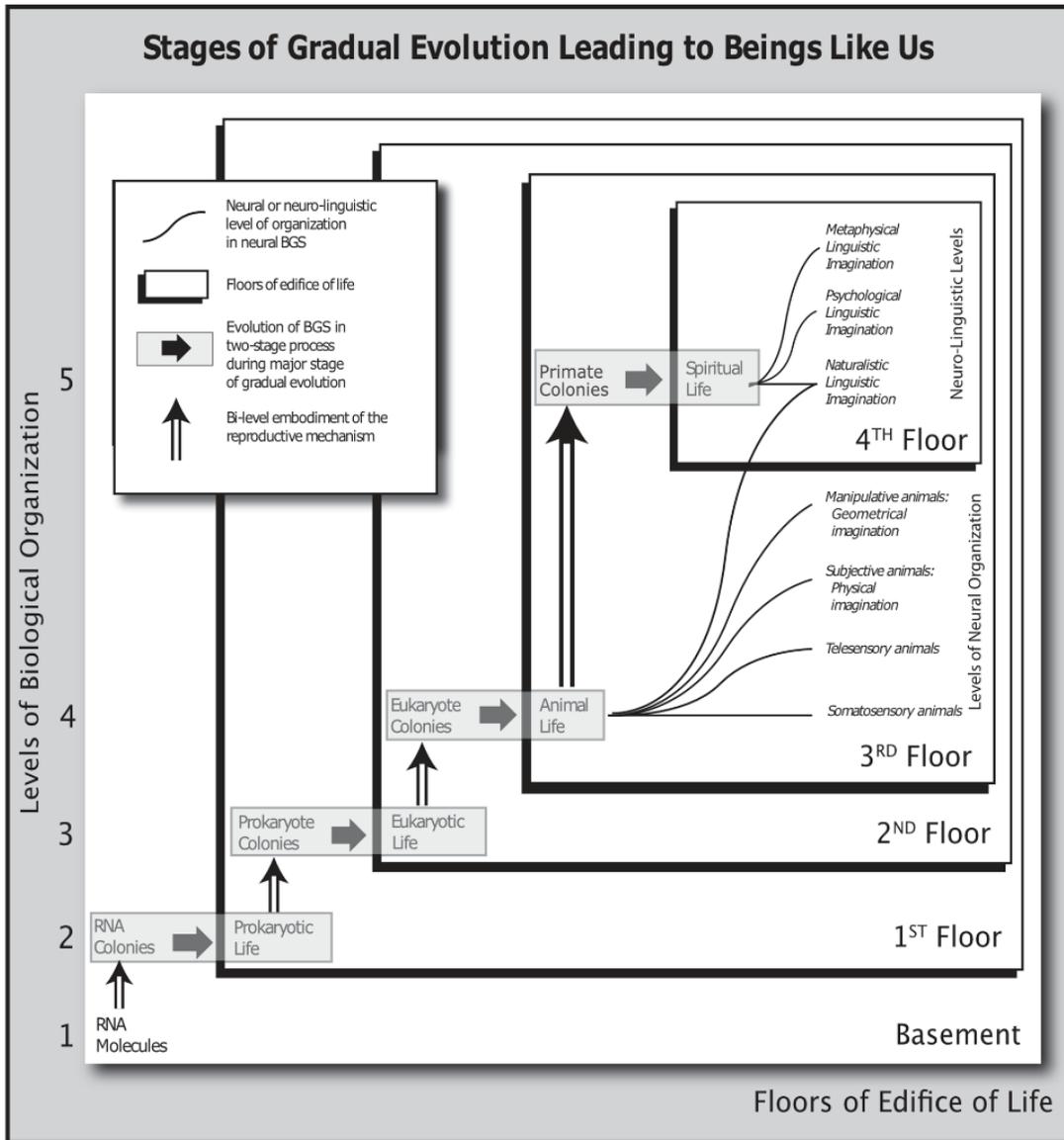
Furthermore, since other sciences study regularities that depend on geometrical and physical causes working together, they are not fully explained by physical causes. These regularities are generated by geometrical causes constraining the collective effects of forces exerted by particles (or smaller composite bodies) moving independently of one another. For example, steam engines are geometrical causes, and since heat is the kinetic energy of particles on the micro-level, their motion can be used to do work on the macro-level. There is a regularity about how much work a given quantity of heat can do on its environment, called the *second law of thermodynamics*, and *Chapter 3 of Volume II* shows how it is explained in the spatio-

material world. This clears up confusion about entropy, a puzzling property mentioned in equations by which physics predicts the maximum work that a heat engine can do. This explanation of the thermodynamic regularity described by physics enables ontology to explain thermodynamic regularities in chemistry, where entropy is even more confusing. In both cases, there is a flow of acceleration fuel (the matter by which particles affect one another's motion), and the geometrical cause uses the flow to do two kinds of work, one that acts *on its surroundings* and another kind of work that it must do *on itself* in order to do work on its surroundings. Ontology calls the way that geometrical causes constrain the collective effects of physical causes *geometrical action*, and it includes both kinds of work. Physicists focus on maximizing the work that heat engines can do on their surroundings (which depends on how much work they must do on themselves), while chemists focus on how much work molecules, as micro-level geometrical causes, must do on themselves (rearranging atoms) in order to do any work on their surroundings. The work that molecules must do on themselves when they interact chemically is the part of their geometrical action that evolves into life.

The recognition of geometrical action is what enables ontology to reduce the regularities studied by specialized sciences to interactions of space and matter. *Part Two of Volume II* is the reduction of life to interactions of space and matter. It explains evolutionary change because it shows that, under suitable conditions, a special kind of geometrical cause (one that can do thermodynamic work in two radically different ways) changes over long periods of time in a certain direction. When it is driven through cycles in which it does both kinds of work, it acquires powers of doing work in one way that promotes the other kind of work it does, and since the other kind of work is reproduction, it changes in the direction of greater functional power until it acquires enough power to go through such cycles on its own. That is when a form of life begins. This way that geometrical and physical causes work together is called the *reproductive mechanism*. Though it incorporates natural selection, it is a deeper and more complete explanation of evolution than Darwin's, so it explains more about the course of evolution. It explains how evolution begins on suitable planets, how geometrical causes of this kind (called *double-action geometrical causes*) evolve into a form of life, and how its origin defines the essential nature of life. The power to go through reproductive cycles on its own comes from acquiring a special kind of geometrical cause, called a *behavior guidance system (BGS)*, and though its initial function is to choose between the two essential ways of doing work, it acquires the

power to make other choices that increase its power to control conditions that affect its reproduction. Since life is essentially a double-action geometrical cause with a BGS, it is a *triple-action geometrical cause*, and since it drives itself through reproductive cycles, life causes itself to evolve in the direction of greater functional power. Furthermore, since what matters to a form of life is choosing the goal in each situation that enables it to go through cycles in which it can reproduce, the essential nature of life explains what makes good goals good, and given the *nature of the good*, issues about which goals ought to be chosen are matters of fact that can be determined objectively. Thus, life is basically just geometrical action aimed at the good.

There is more than one form of life because triple-action geometrical causes on one level of geometrical organization can become the several parts of a double-action geometrical cause on a higher level of geometrical organization, and the reproductive mechanism implies that if it can evolve a new order of functional powers, it evolves into a triple-action geometrical cause on the higher level, that is, a new form of life. These levels of geometrical organization are *major stages* in the overall course of evolution. As *Part Two* shows, the first form of life is represented on Earth by prokaryotes (such as bacteria), and there are three more forms of life—eukaryotes (such as the cells in our bodies), multicellular organisms (such as animals like us), and what I call *spiritual organisms* (made up of language-using animals like us). Since there are forms of life on four levels, the ontological explanation of the course of evolution replaces the traditional *tree of life* with a four-story *edifice of life*, and Figure 3 represents the ontologically necessary series of stages of evolution that lead to beings like us.



**Figure 3 – Stages of Gradual Evolution**

Multicellular animals on the top two floors of the edifice of life have a geometrical cause whose function is to guide their bodies in moving and interacting with other objects in space. It is a *neural BGS*, and since levels of geometrical organization in nervous systems are both possible and functional, the reproductive mechanism implies that there are inevitable *minor stages* of evolution on both the third and fourth floors of the edifice of life.

The origin and essential structures of these neural BGSs are described in *Part Two of Volume II*. Simpler animals have simpler neural BGSs, and since the function of the basic structure at the third neural level is a faculty of imagination, mammals are

*subjective animals*. (See Figure 3). That is the origin of naturalistic imagination, the faculty on which our understanding of interactions of space and matter depends. But beings like us have language, and thus, as explained in *Part Three*, we are members of the form of life on the fourth floor. The use of language serves as a BGS that enables groups of animals to drive themselves through reproductive cycles in which they do both kinds of work necessary for evolution by the reproductive mechanism. I call them *spiritual organisms* because they are a form of life that has no body of their own except all the bodies of their independently-moving, language-using members. More than one level of linguistic (and neural) organization is both possible and functional, so there are minor stages of spiritual evolution. The use of naturalistic sentences enables primate mammals to describe states of the natural world, and using psychological sentences, reflective subjects can describe psychological states. They can represent their own psychological states to themselves as part of the process by which psychological states guide their behavior, and that enables them to see into one another's minds. At the second linguistic level, therefore, members of spiritual organisms are able to cooperate in the pursuit of goals that are good for all of them.

The reduction of specialized sciences to spatio-materialism includes an explanation of the rise of civilization in psychological-level spiritual organisms. Though this explains the civilizations recorded in human history, it is not a complete explanation of the natural world. It does not explain the existence of a science that explains everything in the natural world as deeply and completely as metaphysicians had claimed that Reason explains Reality. Since it comes from reducing physics to ontology, it is a product of a civilization whose functional powers are so great that, instead of falling, like previous civilizations, they are spreading to other civilizations on Earth. Thus, to explain its origin, ontological science must explain the rise of the West.

## **5. UNIFICATION OF SCIENCE AND PHILOSOPHY**

As part of the evolution of life by the reproductive mechanism, science is a product of the evolution of spiritual organisms, and it is a historical fact that science began with the extraordinary success of physics in using the empirical method. Its unprecedented success inspired the scientific study of nature. But as shown in *Volume I*, what enabled physics to describe the seemingly basic regularities in the natural world was the use of mathematics to formulate laws of nature, and that was a treasure from metaphysics. The assumption that mathematics is known independently of

perception turned mathematics into mathoscopes that focus on quantitative regularities about change, and the incompleteness of such explanations caused the puzzles of modern physics and crippled specialized branches of science. For those problems to be solved by giving up intuitionistic naturalism in favor of ontological naturalism, as contended here, the origin of science must be traced to a contribution that intuitionistic metaphysics made to the initial success of physics.

Newton discovered his laws of motion and gravitation using the calculus, a form of mathematics invented by him that can be traced to intuitionistic metaphysics. He learned how to use coordinate systems by studying a book on geometry written by Descartes, the intuitionistic metaphysician who began the modern era of philosophy. Descartes believed that beings like us are minds in which knowledge comes from faculties of intuition. A faculty of *perceptual* intuition was supposed to give us knowledge about the natural world, and a faculty of *rational* intuition would enable us to know that there is a world external to mind. His famous argument, "*I think, therefore I am,*" proved the existence of a mind in which ideas appear to a subject, and he used what he called the *clear and distinct ideas* of mathematics to describe the nature of the substance constituting the external world. This way of using rational intuition allowed Newton to assume that mathematics is known independently of what perception discovers in the natural world. But since Descartes used rational intuition to argue that Reason knows Reality behind Appearance, he was forced to believe that the external world has a nature opposite to mind. He called it *extension*, and its divisibility was just opposite to the unity of a mind. Since minds had bodies in the natural world, Descartes was confronted with mind-body dualism, a problem that famously ruined his metaphysics. To claim that what really exists are substances that explain everything in the world, including Appearance, Descartes had to explain how mind and body interact, and neither he nor anyone who followed him could do that.

Mind-body dualism was not a problem for science because, by accepting naturalism, it refused to assume that knowledge of the natural world depends on a faculty of perceptual intuition. Since animal bodies are located in a world of objects existing independently of one another in space, sensory organs provide knowledge about it that is reliable enough, and naturalists take the empirical method for granted. But for its laws to be confirmed in a compelling way, physics had to assume that mathematics is known by a faculty of rational intuition, and after centuries of using mathematics as mathoscopes to focus on regularities about change, physics turned up intractable puzzles that can be solved only by abandoning empirical lawism in favor

of empirical ontology. Thus, to explain its own origin, ontological science must explain the belief in a faculty of rational intuition, and by tracing it to modern metaphysics, it finds an explanation of Western civilization that not only solves the Cartesian mind-body problem but also solves the historical puzzle about the unprecedented rise and globalization of the West.

This is what *Volume III: Unification of Science and Philosophy* predicts. It depends on two discoveries. One is an ontological explanation of consciousness, and the other is about how consciousness caused mind-body dualism. Consciousness is the obvious way for naturalists to explain what Descartes called *ideas in the mind* because consciousness is the phenomenal aspect of experience, and ontology can explain it as part of a natural world constituted by space and matter. But the ontological explanation of consciousness implies that consciousness is not an efficient cause. It does not make any difference in what happens, and since it does not cause descriptions of ideas or what they represent, it does not explain what Descartes called *mind*. Nevertheless, ontological science can explain the mind. Its explanation of consciousness exposes an illusion inherent in consciousness, and ontology uses that illusion to show how a special way of using language can refer to consciousness as something distinct from the psychological (brain) states guiding behavior. Such verbal behavior describes consciousness as playing a role in causing behavior, and so the exchange of metaphysical arguments is a way of talking that makes the illusion explicit. Reflective subjects describe parts of consciousness as ideas or what they represent (that is, as objects known by intuition), and since this articulation of the illusion together with the ontological explanation of consciousness explains how the mind is identical to the brain, it solves the mind-body problem.

Surprisingly, even though consciousness is not an efficient cause, it helps cause intuitionistic metaphysics. But since it is just an ontologically necessary part of that efficient cause, let us call it a *pseudo-efficient cause*.

The first step of this argument is a straightforward ontological explanation of how consciousness is part of the natural world. It explains consciousness as a property that a part of the geometrical action of the mammalian brain has because matter has a phenomenal intrinsic nature. The brain is a geometrical efficient cause with the function of guiding behavior, and since mammals have a faculty of imagination, they are subjective animals in which brain states represent objects as located in a 3-D space. Since the unchanging geometrical structure of the mammalian brain constrains the collective effects of physical causes throughout the brain, its effect is a kind of

*geometrical action*. But since matter has a proto-phenomenal way of existing in itself, this neural geometrical action has a phenomenal aspect. That matter has a phenomenal intrinsic property is inferred as the best explanation of consciousness, and to say that it a *proto-phenomenal* intrinsic property is to say that it is a way that matter of all kinds exists in itself. In other words, a qualitative property of some kind is immediately present in every bit of matter.

This ontological explanation of consciousness is a form of *panpsychism*. Species of matter are defined by the spatiotemporal structure of their way of coinciding with space, and when a bit of matter has an elementary way of coinciding with space, its qualitative property is necessarily simple and presumably faint. But the holistic power of matter is expressed geometrically, and a bit of matter helping constitute its geometrical action can have a very complex way of coinciding with space. Its phenomenal way of existing in itself can also be very complex. For example, when mammals perceive the natural world, many qualia of various kinds located in 3-D space seem to be immediately present. *Chapter 1 of Volume III* shows how the geometrical action of the mammalian brain explains the complex kinds of perceptual phenomenal properties that are immediately present. Since that is a basic way of being conscious, it explains how consciousness is part of a natural world constituted by space and matter. And in general, consciousness is what it is like to be a mammalian brain.

This does not, however, explain the origin of science because the immediate presence of complex phenomenal properties does not make any difference in what happens in the brain. Since the mammalian brain is a BGS, its unchanging geometrical structure is responsible for its geometrical action. Behavior is the *output* of interactions of neurons in which perceptions and beliefs serve as *input*, and goals are *chosen* because of desires and intentions. But every aspect of experience has a phenomenal character, and since the phenomenal expression of the holistic power of matter depends on its geometrical expression, there is an illusion inherent in consciousness. It naturally seems to mammals that perceptual phenomenal properties that are immediately present *are* what they represent. Their qualia bodies seem to be located in a world of qualia objects in phenomenal space. Not only does the natural world seem to *be* the perceptual phenomenal properties that represent it, but psychological states, such as desires, memories, and emotions, involve phenomenal properties that seem to *be* those psychological states. In effect, mammals are trapped inside consciousness, including mammals who have acquired the use of language.

Naturalistic sentences enable language-using mammals to describe states of affairs in the natural world, and psychological sentences enable them to represent their own psychological states as causes of behavior as part of the very process of causing behavior. But the use of language is part of the geometrical action of the mammalian brain, and since verbal behavior is part of experience, it too has a phenomenal appearance. Hence, the immediate presence of phenomenal properties has no effect on what happens in the brain. It is just what it is like to be a mammalian brain that is able to speak.

But it is not quite that simple because the use of psychological sentences enables mammals to reflect on their brain states, and since there is an illusion inherent in consciousness, it is possible to use language in a way that refers to consciousness as something distinct from psychological states. That way of using language is metaphysics. The illusion inherent in consciousness allows reflective subjects to believe that the immediate presence of phenomenal properties causes the knowledge of their phenomenal properties and what they represent, and that false belief makes intuitionistic metaphysics possible. I call it *intuitionism*. What it is like to be the mammalian brain makes it seem that phenomenal properties are objects that a subject knows by a faculty of intuition, but it is just an illusion inherent in consciousness. But metaphysics articulates the illusion of intuitionism, and that is how consciousness becomes a pseudo-efficient cause of what happens.

In ancient Greece, for example, Plato described visible objects as objects of a faculty of perceptual intuition that exist in the *realm of Becoming*. On that model of knowledge, he argued that phenomenal appearances of meanings of general terms, such as *circle*, *tree*, and *virtue*, are objects known by a faculty of rational intuition. He described them as Forms existing in the *realm of Being*, and as a metaphysician, he tried to show that they are Reality behind Appearance. Since Forms were unchanging and perfect, Plato insisted that they were what really exist, and since visible objects were changing imitations of them, he described it as a mere Appearance of Forms, called *Becoming*. But as ontological science explains Plato's argument, it is a kind of intuitionistic metaphysics in which Reason is a faculty of rational intuition for knowing Reality behind Appearance that parallels perception as a faculty of intuition for knowing the natural world as Appearance.

Plato was a direct realist about perception because, like all mammals, he naturally assumed that perceptual phenomenal appearances *are* the natural world. But direct realism is not true, and ontological science explains Descartes' belief in mind as a

consequence of correcting that mistake.

The history of intuitionistic metaphysics is about cultural evolution because metaphysical arguments are exchanged for many generations and attempts to answer objections of skeptics about Reason knowing Reality behind Appearance leads to revisions. In the modern era, some fifteen centuries after Plato, direct realism was abandoned in favor of representative realism. Descartes recognized that perceptual phenomenal appearances are not the natural world but, rather, part of the subject perceiving it, and since his metaphysical argument was articulating the intuitionist illusion, he explained perceptual phenomenal appearances as representations of the natural world. As a science based on ontology explains the evolution of metaphysical culture, the discovery that the natural world is outside consciousness is the *discovery of consciousness*. It comes from discovering the radical difference between consciousness and the external world.

Descartes called consciousness *mind* and described it as having a kind of unity that is opposite to the unity of the body and the natural world in which the body is located. Believing that clear and distinct ideas are self-evident, he assumed that mathematics describes the essential nature of the substance constituting the external world, and he called it *extension* because he believed that it was necessarily divisible into parts, like space. Though skeptics doubted that Descartes could prove its existence, they did not doubt his proof of the existence of mind. Descartes used the *Cogito*, his famous argument, “*I think, therefore I am,*” to prove its existence, and since he was describing the illusion of intuitionism, even the most skeptical intuitionists could not doubt that mind exists. *Thinking* is the immediate presence of phenomenal properties (that is, ideas), and since there must be a subject to whom they are present, there is a thinker. Thus, looking out from consciousness to a world outside consciousness, the mind has a kind of unity that is just opposite to the unity of the natural world: all the parts of complex phenomenal properties are immediately present to the subject at once, and that is not possible for bits of matter that coincide with parts of space because they are outside one another. The assumption that the mind interacts with a body in the natural world confronted Descartes with the problem of mind-body dualism, and it proved fatal to his metaphysical argument.

Ontological science solves the problem of mind-body dualism by explaining Cartesian metaphysics as an episode in cultural evolution. The discovery that the natural world is constituted by space and matter interacting with one another enables science to explain how consciousness is part of the natural world, and since its place

in the natural world reveals that there is an illusion inherent in consciousness, ontological science can explain the belief that mind is a non-material (non-physical) substance that interacts with material bodies in the natural world as a discovery of modern metaphysics. But it is a false belief, and the mind-body problem is solved by showing that the mind is identical to the brain.

Consciousness is relevant to what happens in the natural world only as the phenomenal aspect of geometrical action expressing the holistic power of matter in the mammalian brain. Descriptions of our phenomenal properties and what they represent are not caused by their immediate presence, as intuitionists assume, because consciousness is merely what it is like to be a mammalian brain. Consciousness is a pseudo-efficient cause. The only effect that the immediate presence of phenomenal properties has on what happens in the natural world is the discovery that the natural world has a unity that is different from the unity of consciousness. This is the discovery of consciousness, and since it depends on the intuitionist illusion making it plausible that Reason knows Reality behind Appearance, it occurs during the cultural evolution of a spiritual organism at the metaphysical stage.<sup>1</sup>

Belief in Reason motivates reflective subjects to argue about metaphysics. These arguments are on a higher level of linguistic organization than the use of psychological sentences because they refer to some parts of consciousness as objects of rational intuition and other parts as an Appearance that depends on the Reality known by Reason. (They refer not only to phenomenal appearances as objects of intuition but also to the psychological states with which they are identical because metaphysical arguments describe ideas as playing the roles of brain states in guiding their behavior, such as representing objects in space and the goals they find themselves pursuing.)

This explanation of the identity of mind and brain shows how the belief that mathematics was known by a faculty of rational intuition was able to cause the success of physics in discovering laws of nature. Clear and distinct ideas of extension are the part of the phenomenal appearance that depend on naturalistic imagination being used to understand the spatial and temporal structure of the natural world, and that corresponds to the quantitative constraint imposed on regularities in a world in

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<sup>1</sup> It does not occur in psychological-level spiritual organisms, even though they have religious practices, such as those produced by psychedelic drugs, zen meditation, whirling dervishes, and the like because they are just altered states that divorce consciousness from what it normally represents, not a way of showing the difference between the unity of consciousness and the unity of the natural world.

which all regularities are generated by interactions of space and matter enduring through time.

Though intuitionism forces metaphysicians to struggle with the problem of mind-body dualism, the exchange of metaphysical arguments enables culture to evolve powers that are out of reach by culture at the psychological linguistic level. Instead of arguments being settled when agreement is reached about which goals to pursue jointly in given situations (that is, pragmatically, as *what works*), agreement at the metaphysical level depends on finding a consistent set of beliefs about everything found in the world that is True by correspondence to Reality. That coherence is a more demanding condition on agreement, and though intuitionistic metaphysics is bound to fail, metaphysical-level culture evolving by Rational selection discovers more about the natural world than can evolve in psychological-level culture by pragmatic selection. Thus, metaphysical-level spiritual organisms acquire powers that are out of reach by spiritual organisms at the psychological linguistic level.

This unprecedented power of Western culture is still recognized as the Enlightenment, and science is not its only product still spreading to other civilizations on Earth. Indeed, the unprecedented rise of the West along with its own existence is the evidence that ontological science uses to confirm its explanation of Western civilization as the metaphysical stage of spiritual evolution. That is an empirical discovery, and since it entails the identity of mind and brain, that identity is an empirical discovery. In other words, ontological science shows that the mind is identical to the brain in the same way it shows that reflective subjects are identical to mammals with the use of psychological sentences. And that is the way that physical science reduces water to H<sub>2</sub>O.

## **6. NATREASON**

If Western civilization is a spiritual organism at the metaphysical stage of evolution, the spawning of physical science during the Enlightenment was the adolescent identity crisis of Reason. But intuitionists continued to argue about metaphysics, and as *Part Two* of *Volume III* shows, their failure to show that Reason knows Reality behind Appearance has led to *endarkenment*. Its failure is now taken as a lesson in hubris, and it is becoming conventional wisdom that there is no such thing as the True. This is, in effect, a return of Western civilization to the psychological stage, and since it will return without a shared religion, there will be no way to agree about goals. Many intuitionists now take the failure of metaphysics to mean that there

is no objective knowledge, and the general acceptance of relativism may lead to an era in which deception replaces argument and might makes right.

But if space is a substance that interacts with matter, the prediction of these three volumes will be confirmed, evolutionary regression will be halted, and Reason will resolve its adolescent identity crisis.

Reason was born in ancient Greece and grew up as an intuitionist. But it watched metaphysics fail, and its adolescent identity crisis began around the time of the Enlightenment when it rebelled against its metaphysical family, accepted naturalism, and started using the empirical method to learn about the natural world. Reason became science, and though it gave up supernaturalistic explanations of the Good, it did not give up intuitionism completely because its explanations were all based on empirical lawism. It assumed that mathematically formulated laws were the deepest possible empirical knowledge of the natural world, and since the practice of physics was based on a false belief about the nature of mathematics, there were quantitative regularities generated by interactions of space and matter that its laws could not describe. Thus, the puzzles that confront modern physics are intractable, and disunity prevails among the other branches of science. The failure to explain everything has led to disillusionment with Reason even in science

But Reason will begin to understand its identity better when empirical ontology replaces the mathoscopes of physics and returns physics to the assumption of its pre-Socratic precursors in ancient Greece. When physics gives up intuitionistic naturalism in favor of ontological naturalism, it will discover the natures of the substances constituting the natural world, including those that explain the “unreasonable effectiveness” of mathematics in discovering laws of physics, and the intractable puzzles of physics will be solved. Science will discover that matter has a holistic power whose geometrical expression reduces the regularities studied by specialized sciences to interactions of space and matter. As ontological science, it will explain the nature of the Good, and when it discovers the illusion inherent in the phenomenal aspect of the expression of the holistic power of matter in the mammalian brain, it will resolve the identity crisis of Reason.

The nature of reflective subjects combined with the nature of consciousness will explain the puzzling rise of a civilization whose growing technological power seems to make it invulnerable to a fall caused like those recorded in history, and ontological science will recognize that it has become naturalistic Reason. Ontological scientists will already know Reality because they will know how space and matter constitute

everything in the natural world, and as scientific realists about perception (as well as the theoretical entities of physics), they will know about consciousness from outside. But as reflective subjects who are conscious, ontological scientists will *discount the illusion of intuitionism* in their explanation of the natural world, and when they recognize that they know Reality behind Appearance, they will find themselves defending the perfect kind of knowledge to which lovers of wisdom have aspired ever since ancient Greece. They will have Reason, and since they will be naturalists, it will be naturalistic Reason.

This is the prediction of a revolution in science and philosophy that is defended in *Part Three of Volume III*, and if it is correct, optimism about the destiny of beings like us on Earth is justified. Reflecting on what Reason knows about Reality, naturalistic Reason will see the natural world in which beings like us necessarily come into existence as making the most out of all possible worlds constituted by substances that endure through time. Copernicus was correct in denying that Earth is at the center of the universe. But beings like us will find themselves at the apex of the natural order in a world that seems to be perfect.