

Paper Title: Finality in Science and Human Life

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Abstract:

Human activities, both in the development of Science and in the Philosophical and Religious quest for meaning, constantly imply the conviction that one can find sufficient reasons to explain the “why” of existence, of order and of personal behavior. A careful use of scientific methodology will reveal its limitations in this regard, since we have to deal with concepts and realities that cannot be subjected to experimental checks and that cannot be quantified to introduce values in an equation. But their presence and importance in human thought and life cannot be denied, since ideas of purpose and free will are the foundations of every society and also of the religious convictions of most people through human history.

While in their own activities all scientists act according to the same presuppositions of human dignity, free choice and the quest for Truth, Order and Goodness, it is frequent to find in abstract discussions some statements that call into question those very assumptions, relegating intelligence to the realm of chance currents in the brain and free will to an illusion, possibly linked to the indeterminacy of quantum-mechanical processes in the neurons. Thus the most meaningful and goal-directed endeavors are finally attributed to chance, a word that ultimately has no content and is equivalent to a childish “just because”.

In biblical anthropology the most daring definition of Man is put forward at the start: The Image and Likeness of the Creator. This dignity confers on human efforts the highest possible value, and on human existence the role of giving a sufficient reason for the existence and evolution of the Universe, even if its development leads to the final state of emptiness and cold that Cosmology predicts. Science, Philosophy and Theology appear as partial ways to know and understand the full richness of reality, from the atom to the Universe, from the simple cell to Man. They provide complementary views, each according to its own methodology and within a restricted area of application, but without conflict or subservience.

Biography:

Fr. EMMANUEL M. CARREIRA, S.J. has Licentiates in Philosophy and Theology, a Master in Physics, and a Ph.D. in Physics from *The Catholic University of America* in Washington, D.C. obtained with work on Cosmic Rays directed by Dr Clyde Cowan, co-discoverer of the neutrino. He taught for 32 years *The Philosophy of Nature* at Comillas University, in Madrid, and Physics and Astronomy at the College level in Washington and Cleveland, alternating semesters. As part of the faculty and staff of the Vatican Observatory he participated in summer courses in Astrophysics. For 15 years he was a member of the Observatory Board of Directors.

He has lectured with the sponsorship of the Vatican in Mexico, Colombia, Peru, Argentina,

Uruguay and Chile. Other invitations have led to talks in Germany and Ireland, and in numerous Spanish universities. He also presented invited papers on Science and Faith in Cali and Medellin (Colombia), at the *Congress on Metaphysics and Science* (September 2000, Rome) and again at Santiago de Compostela (September 2002). His special interest is centered in Cosmology, for its implications for Philosophy and Theology. His e-book in English, *Essays on Faith and Science*, is available in the Web.

Paper:

Within the marvelous richness of life on Earth we encounter as something very special the presence of Man, part of the animal kingdom, but exhibiting a peculiar type of activity that places human life in a new and superior level.

Living things have patterns of activity, due to genetic programming, that do not require learning or presuppose a conscious choice. Those instincts are so necessary for the survival of each individual and of the species that they practically define animal life, since they determine the basic functions of nourishment, self-protection and reproduction.

The specific activity that sets humanity apart in the animal kingdom is *reasoning*, using abstract concepts. Not a type of fixed behavior, but an appreciation of ideas, which are not sense reactions to a concrete material object. Even ideas about matter are processed into universal concepts: this is how science develops, formulating statements that claim universal validity even for things that the senses cannot detect.

Ideas lead to immediate or ultimate causes, *to sufficient reasons, to finality and to ethical and aesthetic values*: something not found in other levels of the animal kingdom. In this activity we include Philosophy, Science, pure Mathematics, Poetry, true “culture”: a way of interpreting our existence in the Universe, that can be expressed in art and that leads to developing aims that give sense to our life and to social structures. Culture is shared through a spoken or written language, reinforced by expressive activities, so that each generation benefits from the achievements of its forebears in a kind of learning that is not found in non-human animal life, and that furthers the purpose of human development.

The steps “ideas-meaning-consciousness” refer to aspects of a single process that constitutes the reality of rational life. There is an **I**, a subject that unifies the experiences of sense perception, draws from them their common elements, synthesizes concepts, establishes their value, *chooses the means* to communicate their meaning, and rejoices with their qualities of order and harmony. The subject recognizes its own identity as the center of an independent, autonomous and purposeful activity, freely developed, even to the point of leading to a behavior that goes against the most basic instincts: we can recall countless people sacrificing their lives for a religious belief or for patriotic duty.

What we think explains the way we act, because it leads to value judgments concerning ethics, and to affective reactions: *we seek what we love and perceive as good*, even when that goodness is different from any reaction of the senses. God as the Supreme Good has led many people to the highest degree of love and selfless sacrifice, while God is known as

totally different from anything we can imagine. The search for Truth, Beauty and Good, summarizes the entire *purposeful* activity of Man as a rational being, who tends towards a reality not found in any description of matter, that cannot be detected by any laboratory instrument, and that cannot be attributed to any of the physical forces.

Consciousness is the primary datum of rational life: we have a reflex knowledge of the fact that we are actually knowing and of states and decisions that flow from what we know. Only in the most imperfect way do we know the brain itself: its tissues, neurons, signal processing, need to be studied using the same instruments and methods required to study the brains of other animals. We know the matter of our body as the source of sense activity, but the external stimuli are much more evident than the processes that occur in the sense organ itself. *Matter is not conscious of itself*: we still do not know how the excitation of the neurons can be related to the content of conscious thought, nor the way biological and psychological levels influence each other.

HUMAN BEHAVIOR

Human Rationality, as already indicated, can be expressed in terms of a constant inner drive to search for Truth, Beauty and Goodness. This purposeful search influences human activity in every field, in the sciences, in artistic achievements, and in ethical and social contexts.

Two logical principles –of identity and non-contradiction- are absolutely necessary for coherent thought and language, and are also a necessary pre-requisite for establishing facts and developing culture in any area of human behaviour. A third principle –the need for a sufficient reason- which implies the need for explanatory causes of whatever it is that we study, is the thrust that leads to science as *an effort to comprehend* (its purpose) that cannot be reduced to a mere catalogue of data. This search for causes answers most directly our need to find Truth (the description of reality that agrees with what objectively exists) and Beauty (the appreciation of harmony and order.)

At the human level of activity, it is the *final cause* that best explains our actions and our concerns. The finality of an object, *its purpose*, is much more important as a reason for its existence and its properties than a list of its physical parameters or a description of how it is produced. This is more obvious still when we deal with personal activities or social developments, where intelligence and free will immediately appear as adding a new and higher dimension to the facts that Physics can describe.

When an archaeologist finds in a tomb a strange block of metal, there will be a first step to understand its nature by analyzing the alloy, the mass and density and chemical make-up of the object. From the data an inference can be made to the origin of the materials used and to the technology responsible for it. But the question “*what is this?*” requires more to be satisfactorily answered. We seek the reason why the object was made, and why it was given the shape and size it has. *We finally want to know its purpose* and all other data are meaningless without an answer. Is this also applicable to questions about the Universe and the properties of matter?

SCIENTIFIC METHODOLOGY: STRENGTHS AND LIMITATIONS

The word *Science* in its original usage meant the search for understanding in causal terms. In the technical sense, in our time, we distinguish the *Sciences* from the *Humanities*, attributing to Science the effort to know the world of material nature as an objective reality, independent of human prejudice, culture or personal wishes. A reality that is accessible through observation and experiment, giving rise to quantitative measurements (not only qualitative descriptions) that can be incorporated into mathematical relationships to infer new properties or activities of matter and to predict or explain future and past events. In Einstein's words, "...this huge world, which exists independently of us human beings...stands before us like a great, eternal riddle, at least partially accessible to our inspection"¹.

In the physical sciences we look for *efficient causes* of a more or less immediate level with respect to the observed effects. Physics (as the science of the material world) deals only with the activity of matter, in its interactions with observable nature and with our instruments.

This methodology leads to universal statements of active-passive properties of specific entities (operational definitions) and of patterns of activity ("laws of nature") that are based upon those properties: *what things are determines what they do*. Structure and activity should be understood in the simplest terms, with the largest area of applicability, without introducing any personal preference in the logical choice of data or required presuppositions.

Modern physics accepts in the present world only four basic interactions or sources of activity: gravitational, electromagnetic, strong nuclear and weak nuclear. Their strength, range and effects are clearly specified and measured: attractions, repulsions, changes in particles; we thus invoke each when required, to explain cosmic structures, element abundance and properties, chemical activity and even physiological processes. And because science can only define reality in terms of its activities, *matter is defined as anything that can act through, at least, one of those four forces*. If there is something that cannot be attributed to them, its source cannot be matter.

The ultimate check for any scientific hypothesis or theory remains always the possible confirmation by experiment and measurement. The observed behaviour of matter has to be compared with the expected outcome according to the forces and laws invoked in the theory. Agreement with prediction will strengthen the theory, even if it can never be considered as totally proven; any incompatible result will necessitate a change or reformulation, or even the total dismissal, of the original explanatory paradigm.

Because of this strict requirement of observable and measurable results, no problem can be scientifically addressed unless we know or specify the *initial conditions* of the system and the applicable *laws for its development*. No inference or deduction is possible without a known state to begin the process, and no development can take place if we begin with an initial nothingness or infinity: no physical law allows for the strict creation of even a single

particle (or for its true annihilation.) The most basic *conservation law* stresses the nature of science as a description of the behaviour of *existing matter*.

Similarly, the introduction into any equation of a parameter or entity that cannot be experimentally verified *in principle*—like a strictly infinite value—destroys its usefulness for predicting an observable result. And a different “universe” is not science but science fiction: no verification is possible, either directly or indirectly.

It is clear from this schematic description of scientific work that science can address only those questions concerned with the “how” of material processes and the restricted “why” of partial causes involved with the outcome. In many cases such causes can be identified as “necessary and sufficient conditions” for something to happen. But the most basic questions about the material world, and questions addressing behavior due to intelligence and free will, lie outside the field of science. Why is there a world of matter? Why do we find four forces with their specific strengths and patterns of activity? How is human activity related to those forces? What is the explanation of consciousness, meaning and free will? What is the *purpose* of the Universe and of human existence? In the words of John Archibald Wheeler, if we cannot explain the relationship between the material Universe and our existence, we should confess that we really understand nothing².

THE ORIGIN OF INTELLIGENCE

Intelligence cannot be explained in terms of attractions or repulsions, or of waves or particles, and in consequence the four physical forces appear as totally unsuited to produce a thought or a free act. Since *none of the forces by which matter is defined* is a sufficient reason for consciousness and intelligence, it becomes necessary to accept a different cause. A new non-material (spiritual) reality must be present in Man, intimately joined to the biological element, and making a whole capable of two different kinds of activity, with mutual influences but with diverse results. This is not a “dualism” that postulates two independent beings joined in a temporary union; but rather the acceptance of two real components that cooperate and influence each other as parts of *a single substantial being* that is meant to exist as such. We reject dualism, but we are logically forced to accept a duality of active elements intimately united in a single subject.

This union is difficult to understand, and we cannot clearly explain the mutual conditioning of matter and spirit, or the fact that the person is one and remains as one through all the changes that the body undergoes through life, but the fact that we cannot explain it does not invalidate the reasons presented for its acceptance. The only alternative would be to postulate an *unknown and undetectable* “force” to produce consciousness, a force already present in elementary particles, that would increase its efficiency as the material structure grows in complexity, not just in the number of particles. Such hypothesis changes the definition of matter, pushing it beyond the limits that are acceptable in the physical sciences, based upon experimental checks.

This is, nevertheless, the implication of those viewpoints that accept biological evolution as the *only* reason for intelligence, considered as the necessary outcome of a *greater brain development*, which is attributed to secondary factors. But even within the human race, intelligence cannot be correlated with brain size: Neanderthal man had greater brain mass than we do, and the trend in the last 10 thousand years seems to be to some reduction of brain volume. In our time, people with brain tissue limited by hydrocephalic conditions, have shown no loss of intelligence, and in some cases have had an IQ quite above the average.

INTELLIGENCE AND FREEDOM

Materialistic evolutionism has included the suggestion that there was an initial genetic programming of organisms to have them develop intelligence, with the programming attributed to chance (or even to extraterrestrial visitors.) This hypothesis cannot explain the facts: a genetic code can only determine new organic structures or instinctive behavior, but not mental processes that have no material output. We cannot program a computer to be self-conscious or to act freely to choose what to do and why, even if it is possible to have its functions determined by chance numbers as a response to data received from the human operator or from some instrument. And we never accept that even the simplest computer program might be due to chance currents in electronic circuits.

It is still possible to insist upon the trite examples of blind processes (either *deterministic* or due to *chance*, neither of them related to purpose) achieving the same results as human intelligence for the production of literary or other artistic works. The permutation of a few letters will lead to meaningful words being written automatically, and the systematic rearranging of billions of symbols of an alphabet will lead to the production of all the possible literary works that can be written with those symbols. This is presented as meaning that results attributed only to intelligence and conscious purpose can be obtained blindly, or that such processes lead to what we call human intelligence.

These examples are misleading, because they presuppose that the letters of an alphabet, and the words composed with them, have a meaning *by themselves*, when it is clear that the opposite is true: they are *arbitrary symbols* that required a previous and conscious determination of a relationship between shapes and meaning. We need a language, a writing system, a grammar, and those elements have to be known to the observer who checks the outcome of those permutations. Otherwise, we shall simply have stains on pieces of paper.

”Chance” is not a physical force, but only a word to indicate that we are talking about objects or events that are unrelated by any common cause. Thus chance is never a sufficient explanation for anything, and it cannot be said to be the reason for order, constancy or structure. To attribute to chance the reality of abstract human knowledge, where the highest degree of complexity and order is found (the reason for Science, Art, Philosophy) is truly to dismiss our rationality as meaningless and end up by saying that our human culture can be explained with a childish “just because”.

To hope that some future theoretical progress will lead to the explanation of consciousness and intelligence in terms of forces and particle structures, at deeper levels of matter, hides a prejudice that denies the very methodology that it claims as its justification: a scientific status is postulated for

something that has *no experimental proof in any known fact*, nor can be shown to follow from any well established theory. It belongs to the realm of science fiction.

We might reflect upon the fact that the “information age”, where the most vital and fast growing technology appears, deals with something *that is in itself intangible and without physical properties*. The magnetic domains in a computer, or the ink stains on a sheet of paper, do not constitute by themselves real information without the human effort to develop a code, a program or a language. A thought is not a “thing” with mass, electrical charge, size or color. No scientist admits that our thoughts influence the behavior of any object in our laboratory experiments, even at the most minute level. And we cannot equate a given number of different atoms -or electrical impulses in the brain- with a person’s identity, as if the ideas, the driving purposes, the scientific, artistic or ethical achievements, or the human experiences of the person, were totally without value or relevance at the individual or social level.

An objection is frequently made to the acceptance of human freedom –and thus also of finality and purposeful behavior- by stating that it is incompatible with science. From a deterministic viewpoint, science requires certainty in its predictions, at least in principle, and free acts cannot be predicted. Starting from an opposite postulate, it is said that any activity is a *chance event* observed within an infinite number of probabilities that *must be realized* for every set of initial conditions. In both cases the human certainty that we are purposeful and responsible for our actions, with ethical and juridical consequences, is dismissed as an illusion.

The probabilistic interpretation of Quantum Mechanics is taken to absurd limits by asserting that anything that is mathematically possible (it has non-zero probability) *must occur* as a real outcome of any process. This leads to accept infinite universes, postulated to accommodate all possible values of the wave functions that describe either microscopic or large scale systems. The simple fact that such ensemble of universes is gratuitously affirmed, without any possibility of verification, is enough to relegate the theory to a non-scientific “mythology”.

Chaos Theory tells us about the limited certainty of predictions in complex systems. It does not imply lack of order or random events, but a complex interaction of many elements that renders the exact prediction of the outcome impossible in practice. The sensitivity of the process to minute changes in initial conditions makes the future state unknowable in the long term. But science is not rendered impossible by such limitations of our ability to deal with many inter-related variables, just as it is not destroyed by the theoretical impossibility of knowing what is happening within a black hole.

Free will is the basis for our responsibility, without which human society cannot exist, nor can there be a meaningful concept of duty, human rights and justice, of personal ideals, of purpose. It is obvious that no proponent of its denial wants, in real life, to accept its consequences, which would render human activities as free of blame or praise as the blind fall of a stone to the ground. The final attitude is an absurd schizophrenia, contradicting with personal behavior and the demands made from others what was dogmatically presented at the theoretical level.

Humans are subjects of duties, leading to rights that guarantee their development as rational animals: rights to be cared for in a family, in order to be fed, to grow, to be educated, rights also to engage in legitimate activities as individuals and in a society context. And because all human individuals share the same dignity in this regard, it is never permissible to degrade a person to the level of a *thing*, something merely useful for the whims or profit of others. Slavery, abortion, euthanasia, genetic manipulation, deny the dignity that each human being receives -not from society or any kind of democratic vote- but from the very nature of being human, as a patrimony that each individual can never be deprived of.

The supposed conflict between freedom and scientific predictions rests upon the idea that material laws have to explain something that is not due to matter. Physical laws allow me to describe in detail how I flex my arm, how the muscles, tendons and bones interact, to make the arm bend. But they cannot explain why the arm bends when I WANT. This is the core of the question: the physical explanation does not cover everything, just as the reflection of light from the pages of a book says nothing about the joy of reading a poem or the insight of understanding a mathematical formula.

PURPOSE IN BIOLOGY

Within the sciences dealing with matter, the question about purpose is most pressing in the realm of life, even non-intelligent life. It is impossible to describe organs and functions of a plant or animal without reference to a finality for which the organ is perfectly and uniquely adapted, with activities related to the development and subsistence of the whole. The eye is an instrument whose purpose is to react to light in a way suitable for the well being of the animal; the flower has to be described with reference to the propagation of the plant. Even structures within a simple cell must be identified as clearly suited for some specific activity and not a different one. And the development from the fertilized ovum to a complete organism, comprising perhaps a hundred trillion cells, follows a well organized process, where each step is perfectly harmonized within a master plan to gradually develop organs and systems of incredible complexity, all of them needed for the good functioning of the living entity.

But science, relying upon experimental measurements, *cannot detect finality directly*: there is no instrument capable of measuring it and it cannot be inserted into an equation. This is always true, even when dealing with the most clearly *purposeful* products of our technology.

No scientist can *prove* that a bottle was made for the purpose of containing a liquid, or a pen for the purpose of writing, or a car or a boat to travel on land or water. In all those cases (which can be extended to every product of technology) we *infer* the purpose of an object from its *unique suitability for a specific function*: the object has the necessary and sufficient properties for a concrete use, and we can argue that any non-trivial change in its design, size, mass, rigidity or other parameters would render the object meaningless. We can still accept changes in properties that do not affect the suitability for the inferred purpose, because they might serve a secondary goal, perhaps of an aesthetic nature: the styling of a car, the paint on a boat, the shape and capacity of a container.

We are entitled to apply the same reasoning in the study of biological structures. *Their unique suitability for a function is indicative of purpose*, not because we imply that the plant or animal chooses the parameters of an organ to attain an end, but because the inference to purpose is still valid when we do not know how the purpose is “chosen”. Even Charles Monod, in his book “Chance and Necessity”, after denying finality in the biological world, admits a “teleonomy” that is just finality in disguise.

Darwin’s evolutionary theory provides a descriptive mechanism for variation in heredity, but it becomes unscientific when it claims that evolution is *fully explainable* in terms of chance and the survival of the fittest. First, because—as previously indicated in a general way—chance is equivalent to a “*just because*” that explains nothing: it simply affirms facts for whose *correlation* there is no causal explanation, but chance is not a measurable parameter of matter nor a physical force, nor can it produce regularity and order. Second, because there are numerous instances where living forms remain unchanged for hundreds of millions of years, while in the same environments other animals or plants do change in the fossil record. Third, because there are extremely complex structures and functions that cannot be explained in terms of successive small changes (as proven by Michael J. Behe’s examples in his book “*Darwin’s Black Box*” and in his reply to critics in “*Science and Evidence for Design in the Universe*”³.)

PURPOSE IN COSMOLOGY: CREATION AND THE ANTHROPIC PRINCIPLE

Modern Cosmology is based upon Einstein’s Theory of General Relativity for its logical structure and upon Hubble’s discovery of redshifts proportional to distance for galaxies outside the Local Group. Both contributions stress the evolutionary nature of the material world and lead, in strict scientific inference, to a beginning in a state of high density and temperature: the universally known primordial *Big Bang*, supported by data regarding the Background Cosmic Radiation (data of Penzias & Wilson, COBE and WMAP space observatories), as well as elemental abundance (Helium and Deuterium.) The age of the oldest stars, the abundance of quasars in the early period of 12 billion years ago, the longest-lived radioactive elements, confirm the description of an evolutionary Universe where particles, energy, the physical vacuum, space and time, appear in a sudden burst about 14 billion years ago.

The instinctive question “what was there before the Big Bang?” is answered with a baffling “*there was no before!*” Any attempt to postulate a previous stage runs against scientific methodology: there is no possibility of checking the supposed pre-Big Bang nor of specifying its reason for existence, or the parameters that would explain its effects upon the observable world. With an unacceptable change of meaning Alan Guth claims that the Universe appears spontaneously from *nothing* (as “the ultimate free lunch”) because “nothing” is unstable due to its quantum mechanical nature. It is clear that the so-called “nothing” is the *physical vacuum*, endowed with electromagnetic, geometric and quantum properties, quite a different reality from the total negation that the word “nothing” conveys.

The only word that describes the infinite step from real nothingness to something, even for a single particle, is *creation*, in the strict philosophical meaning of *total beginning of existence without any previous substrate*. It is an event that cannot be described by arguing from previous initial conditions and laws of development: there are no initial conditions before creation, nor laws to determine what

will be created and why. This is also the meaning of a poem by John A. Wheeler addressed to Copernicus: “*Remind us each day of the greatest mystery of all, why there is something rather than nothing*”⁴.

The “why is there something” can be underlined by asking, “why does the *something* have the properties it has”. Since there is no previous state to infer from it what the actual parameters of the material Universe should be, the reason for existence by creation should also be the reason for the initial properties from which evolution should explain the present state after billions of years. This means that the Universe, in its most primitive condition, needs to be “adjusted” so that its evolution eventually develops every structure that we now observe, including the environment where life, based on the properties of matter, can exist even at the level of intelligent human life.

It is surprising that scientists, not philosophers, are explicitly seeking a link between our existence and the Universe at large. From the remarks of Paul Dirac about dimensionless ratios (between times, sizes and forces in the macroscopic and microscopic levels of nature) Robert Dicke formulated in 1961 the *Anthropic Principle*, later developed further by C.B. Collins and S.W. Hawking, and then by Brandon Carter, George Gale, Barrow and Tipler. In a particularly explicit way, Wheeler develops the idea of “adjustment” in terms that parallel the philosophical idea of contingency leading to a non-contingent Creator. It is worthwhile to follow his reasoning.

“Today mutability appears more and more to be the universal feature of nature, showing up at level after level of structure”... “there is nothing that does not change”. Then “Mutability implies adjustability. ... Is the initial adjustment of the Universe made in such a way as to render possible the existence of the knower?” Wheeler lists a number of possible changes in the initial properties of the Universe, from its total mass to the relative strength of the forces and the constants of the quantum world. And he shows that the consequences of any non-trivial change would render impossible the existence of macroscopic life, fully developed to the level of intelligence, if we still apply the known laws of Physics. *The Universe had to be adjusted* in a very detailed way in order for human life to be possible, because whatever is not constrained *by its very essence* to exist in a unique unchanging state (as the changeability of matter proves) cannot be the sufficient reason of its own real existence (in a specific state) or of its initial properties.

We are thus led to the need for a non-changeable reality, *non-material*, that is outside of the realm of time and space (which are parameters of matter) where change takes place. Only the non-material Creator -with strictly infinite power- can bridge the gap between nothingness and something. The concept of creation is unavoidable even in the hypothesis of an eternal and unchanging Universe, as proposed by Bondi, Gold and Hoyle to avoid the sudden start of the Big Bang. Since each star is a furnace using a finite amount of nuclear fuel, the fact that the Universe still has stars shining requires that new stars be formed constantly *out of nothing*, and the theory was described either as the “Steady State” or as the “Continuous Creation”. But even the creation of a single particle cannot be inferred from any physical law or process: the so called “particle creation” of modern Physics is rather the coalescence of energy into particle-antiparticle pairs, just as the “particle annihilation” is the change of particles into energy with exactly the same equivalent mass, according to Einstein’s famous equation, $E = mc^2$.

With a simple and suggestive use of mathematical symbols, we could say that neither the symbols for zero or infinity represent real numbers: they cannot number anything that exists in our experience. The zero is equivalent to nothingness, and infinity cannot be introduced into any mathematical development. But $0 \times \infty = \text{any number}$: only the infinite acting on nothing can produce something of a different order of both.

The sufficient cause for the existence of matter must simultaneously choose the initial parameters and laws of the created world so that it will be fit for the development of intelligent life. The choice has to be made from a potentially infinite variety of universes, where even the dimensionality of space and the basic forces and particles could vary endlessly, but that would be sterile, unsuited for life. Only an infinite intelligence can choose freely the Universe that is correctly and accurately designed to harbour intelligent life. As the traditional philosophical dictum states, “every intelligent agent acts for a purpose” and this should certainly be true for the intelligent Creator.

We have then the most explicit conclusion to the *power of finality, of purpose*: only for a sufficient reason can the existence of the Universe be understood, as well as its parameters and the deepest properties of matter. The intelligent and free Creator –a personal Being, not a blind abstract “nature”- does not create in a meaningless exercise of arbitrary power or in a necessary “development” incompatible with an unchanging essence. Nor does the mere existence of stars burning through billions of years into dead cinders suffice to explain creation. Only setting the stage for personal relationships with intelligent creatures logically suffices as the finality, the purpose, of the creative act.

Wheeler shies away from this logic invoking a vicious circle supposedly based on Quantum Mechanics. He asserts, in a reformulation of idealistic philosophies, that *only that which is known is real*. He then asks us to accept that the Universe is real because we are observing it, and this act of knowing determines what conditions were present at the Big Bang in order that we might exist to make real the Universe we observe now⁵. This would logically mean that there was no real Universe until Man appeared on Earth, a conclusion that no scientist would subscribe to.

THE EARTH, HUMAN EXISTENCE, AND FINALITY

Even after we establish the need for a finely tuned world permitting the development of galaxies, stars, planets and life, we still find surprising requirements for a habitable planet like the Earth, constraining the type of star, the orbital distance, the planetary mass and composition, even the climate as influenced by axial tilt, the presence of a large satellite, plate tectonics and a significant magnetic field. If we were designing the Earth from scratch *for the purpose of being the abode of intelligent life*, we would have to end up with a planet practically identical to our present home.

We still cannot even guess, in a real quantitative calculation, the probability of existence for other inhabited planets, but no scientific argument supports the actual presence of life anywhere else in the solar system. The immense distances to other stars place the detection of planets of similar mass to the Earth and of comparable orbital distance to a Sun-like star orders of magnitude beyond the accuracy of our present technologies. We might be forever unsuccessful in our instinctive effort to establish scientifically if we are or not alone.

We cannot explain how, when or where life started. Its development through eons of evolution is only understood in very general terms, with great gaps in the fossil record and questionable explanations for specific steps. Cosmic catastrophes played an unpredictable role in the ascent of life, both changing the properties of our planet and drastically affecting biological evolution by at least five great extinction events (the latest, the disappearance of the dinosaurs). But an inner drive seems to be present, pushing life forms to the greatest possible variety and complexity. Evolution seems to show that living matter has a built-in tendency to develop new forms to the limits allowed by the physical forces that determine biology, while this tendency appears to depend upon random factors, without finality. We face a contradiction when discussing life and evolution: *chance cannot be the sufficient reason for any kind of order or purposeful activity, and this kind of activity is the most obvious property of living things*. And finality is certainly essential to understand the nature and free activity of Man.

THE IMAGE OF GOD

Christian revelation, and its biblical forerunner in the book of Genesis, provides us with a surprising "definition" of Man. Not by philosophically stressing his nature as a "rational animal", but by referring him to his Creator: he is "*the image and likeness*" of an Omnipotent Being, Eternal, All-knowing and infinitely Holy. In some way, he reflects the One who, by His very essence, is Absolute Perfection.

This is diametrically opposed to the way of thinking found in the mythologies of all other cultures where the gods are described as "images of Man", enlarged to a super-human scale, but with the features, passions, and even cruelties, found in human beings. Since mythologies are the product of the inventiveness of poets who develop ideas found in their societies, it is logical to expect that they will only extrapolate to those divinities their own human experiences and thoughts.

The biblical and Christian God is not so limited: time after time, His Being and His way of acting are stated to be "*not like that of Men*." His eternal existence places Him outside of time itself ("*for You, a thousand years are like yesterday, already gone*"); His Omnipotence, without being arbitrary, implies a total dominion over all reality, spiritual, material or historical, allowing the creation of something from nothing, and the ordering of human destinies. His Wisdom knows no limit, showing itself in the marvelous order of creation and in the incomprehensible depth of His providence. His Holiness, places Him on a new level of fidelity, of impartial justice and undreamed mercy: He is the ultimate source of all good. His very nature, different from that of the material world, transcends any spatial measure: the heavens *cannot contain Him*.

Faced with this overpowering description of a reality we cannot comprehend or express in our language, that surpasses all our imaginative efforts and the inventions of all cultures, it is surprising that Man is called His "image and likeness", as the Bible puts it from the first moment when it speaks of human existence. The reason cannot be sought in some kind of corporal shape or in any other "likeness" due to superficial or changing qualities. It must be a likeness based upon the most intimate level of the human person, which in its powers and activities must reflect the way God is and acts. And God acts intelligently and freely, for a purpose. Because of his intelligence and free

will, Man can be the co-worker with God in developing the material creation that is put under his care.

This is shown when Man is presented with authority and dominion over the Earth and all its living creatures; he exercises this power by assigning to each a name, chosen as suited to the nature of each animal. He is made from clay, but he has a “breath of life”, a spirit that comes from God Himself, and he is destined to live forever, as God does. As the culmination of the creative process, he is *the purpose for which everything material is also created*.

When sin destroys the original closeness between God and Man, its immediate consequence is the loss of the immunity from death: Man ceases to be like his Creator, whose essence is to live forever. To be “an Image of God” is the glory of Man, as the most perfect of all creatures of the material world; “To be like God” is the temptation to seek a self-sufficient and absurd independence from the Creator. The distinction is crucial: the purpose of the second attitude is to avoid God, whom Man tries to challenge as a rival; the first title implies an affectionate nearness, because the best image -real and alive- of any living being, is a Son. And God is essential Life.

In the New Testament, the teachings of Christ give us the final and clear revelation of God’s nature: He reveals Himself as a Trinity, a family. It is the Son, the Image of the Father, who as the “Word” expresses all that the Father is in so far as His Being can be known by us. Christ is “the Image of His Substance”, the perfect and essential Image because of His divine nature, and also an Image by being a Man, perfectly fulfilling the likeness that the Creator sought in Adam and Eve. The Son made Man is the embodiment of all levels of existence, from the humble ashes of stars that prepared matter for the planet Earth and the human body, to the very highest level of eternal life in the Trinity.

The early books of the Bible show no explicit hope of anything beyond earthly life: the just man is rewarded with wealth and children to carry his name, but nobody can praise God after death, and human life can ultimately appear as pointless. Only in later times, in the book of Maccabees, do we find a belief in life after death, a life that implies a new body given by the Creator to those who have died for their fidelity to His Law. We have to look for the outcome of this long process in the beliefs of sincere Jews at the time of Christ: Christ speaks about the resurrection assuming these beliefs, without causing surprise among His listeners. He talked about an inner reality in Man that is more precious than the body, of a worship of the spiritual God in “spirit and truth”, of entrusting his spirit to the Father when dying upon the cross.

Greek Philosophy was very soon put to use in Christianity to express with greater clarity the reality of a human nature where matter and spirit, body and soul, form a single unit of activity, which needs to be constituted by both elements in order to be truly human. In Greek thought we do not find a disregard for matter as evil, nor is Greek culture “materialistic” either: the spirit of Man is paramount, with the highest value placed upon wisdom, art, and freedom. Not surprisingly, these cultural viewpoints were adopted as being well suited to express the Christian belief regarding our nature and our future, and the philosophical terms of “matter and form” were widely used in Philosophy and Theology to describe the mutual interdependence of matter and spirit in the one subject that constitutes the human person.

The idea of a spirit, as opposed to matter, implies a freedom from constraints of physical laws, from the decay and ultimate death that accompany animal life. Immortality should be a property of whatever has no perishable parts that can wear out or become disorganized, but a life of Man as just a spirit seems to contradict our very nature.

Because Man is an Image of God, we have to be an assertion of life with our entire being, not only with our spirit. The scientific description of the evolving Universe leads to the prediction of future conditions that will be incompatible with life of any kind, based on matter. Only the presence of a non-material reality in Man, of a spirit, which cannot be explained by any evolution due to physical laws, leaves the door open to a survival, at least, of that new element. To that basic possibility, Christian faith adds the promise of a full human existence, that confers immortality and eternity - a life of being "like God"- even to our material bodies.

An existence that imitates the eternal life of God cannot be subjected to the flux of time or the need for food and air: we shall be, in the words of Christ, "like angels". Even our bodies, while material forever, will be "spiritual bodies", free from the restraints of physical laws: they will be images of the risen Body of Christ. Thus the Son, Image of the Father, will be reflected in each human being, called to partake of the life of the Trinity.

The very temptation of Genesis will become a promise with a new and fuller meaning: to be "like God" will no longer imply a rebellion, but a fulfillment of our very nature, created in the "Image of God" our Father, intelligent and free, living forever, attaining the finality for which the Creator gave existence to the material Universe.

UNDERSTANDING REALITY

From the ensemble of data gathered by the most varied means we must proceed to true science by the steps of abstraction and universalization, which rest upon a deep philosophical reason: the behavior of matter is attributed to its essence. Things act as they do because they are what they are, and their interactions may be expressed in terms of relationships of different kinds which allow us to specify different fields of knowledge. Thus we can define:

- Physics (in a very general sense: the sciences of matter according to present-day technical language): the study of relationships that are experimentally verifiable and can be quantitatively expressed, regarding the activity of matter at all levels. This includes Chemistry, Biology, Geology, Astronomy, and all their specialties and interdisciplinary fields (Biochemistry, Genetics, etc.)
- Mathematics: the study of exclusively quantitative relationships, with no reference to any kind of matter in concrete. It seeks no experimental check; its certainty rests upon logical inference.
- Philosophy: the study of entitative relationships, whether essential or accidental. Equally without experimental check, it relies on the process of logical reasoning based on the universal principles of identity, non-contradiction and sufficient reason.

If we want to round this view of human knowledge, we might mention and define Theology as the

part of knowledge dealing, not with sense data from the external world, but with a Revelation that communicates Truth of a supernatural order, not attainable by natural means, but which cannot be contradictory to truth obtained by each kind of knowledge in its own field.

These are, obviously, partial ways of knowing the richness of the Universe and of our own personal nature and experience. None of them, by itself, suffices to describe and understand reality, and thus they are all worthwhile and even necessary for a more complete picture. The specific methodology of each imposes its limitations, and also points to its strengths. One cannot ask from a physics laboratory an evaluation of poetic merit or a judgment of ethics; science cannot pronounce itself about the existence of the Creator, since no experiment can be designed to test either its denial or its acceptance.

Similarly, Philosophy or Mathematics cannot determine the initial state of the Universe without recourse to the data of Physics and Astronomy. More evidently, Theology will not teach us about the properties of matter or the laws of its activity.

But it is in the human person, where matter in all its richness is joined to the spirit, where all the ways of knowing converge: Man is truly the “Microcosm” of traditional Philosophy, and it can be understood without contradictions only in the view that gives us an open horizon to eternity, avoiding the absurd of a marvelous Universe that is created and then destroyed for no purpose. A senseless viewpoint that becomes even more irrational if the same process is supposed to go on indefinitely in endless cycles, for which there is no evidence whatsoever, empirical or theoretical.

This is the contribution of biblical Theology and Anthropology, based upon Revelation, but also in full convergence with the best ideas of Science and Philosophy throughout the centuries.

NOTES

1. From “Autobiographical Notes” in *Albert Einstein: Philosopher-Scientist*, edited by E.A. Schilpp (Harper and Row, New York, 1959), quoted in “Albert Einstein: 14 March, 1879 – 18 April, 1955 – A guide for the perplexed” by Kenneth Brecher, 1979, *Nature* 278:215
2. John Archibald Wheeler, 1974, “The Universe as Home for Man”, *The American Scientist* 62:689.
3. Michael J. Behe, 1996, *Darwin’s Black Box*, New York, The Free Press (Simon & Schuster, Inc.) Also: Michael J. Behe, William A. Dembski, Stephen C. Meyer, 1999, *Science and Evidence for Design in the Universe* (“The Proceedings of the Wethersfield Institute”, vol. 9), San Francisco, Ignatius Press.
4. Ref. 2, p. 691.
5. Ref. 2, p. 689.

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