

Natural Theology Revisited:

A Scientific Approach to the Question of God

by Kurt Bangert

I. Background

In the history of ideas, there is the old concept of *natural theology* which assumes that man can have knowledge of God through looking at nature. Natural theology was not only advanced by great Greek philosophers such as Plato and Aristotle but also by renowned church fathers like Augustine or Thomas Aquinas. The idea of recognizing God in nature was also advanced by the Apostle Paul who, in his letter to the Roman church, asserted that God's "invisible attributes, namely his eternal power and divine nature, have been clearly perceived, ever since the creation of the world, in the things that have been made" (Rom. 1:20).

Natural theology is almost always linked to the idea that man's *reason* is sufficient to recognize God in nature. The Greeks emphasized the *nous* or *logos* (reason or logic) as a means of acquiring knowledge in general and knowledge about God in particular. For Aristotle, reason was the basis of philosophy as well as science. Our ability to think leads us to assume a cause behind every effect. Any movement must have a mover behind it. Hence, there must be a First Mover behind the world's first movement, a Mover who is Himself unmovable.

Natural theology has been distinguished from *revelatory theology* which assumes that God has – in some supernatural way – revealed Himself to mankind in a way going far beyond what natural theology can offer. It is also assumed that through revelation God has communicated to man essential knowledge required for salvation. While natural theology requires *reason*, revelatory theology requires *faith*. All three Near-Eastern religions have traditionally assumed the concept of revelation although they may have differed on their respective understandings of what *revelation* means.

Natural theology has been widely criticized by both philosophers and theologians, and there are those who deny any knowledge of God through nature and/or reason while others have defended the idea. David Hume, Immanuel Kant and Arthur Schopenhauer were among the philosophers criticizing natural theology. Kant, for instance, argued that reason is insufficient to prove God. Though Kant was no foe of reason, he rendered natural theology obsolete. The only argument in favor of God which Kant conceded was the notion that God is a moral imperative. God to him was a moral necessity.ⁱ

In theology, Protestant theologians like Karl Barth, Wolfgang Pannenberg or Eberhard Jüngel have been opponents to natural theology. They were convinced that God is essentially different from, and entirely beyond, the natural world so that God can never be known through nature or the natural sciences or through reason alone. Catholic theologians, on the other hand, have had a tendency to defend the concept, partly because it was firmly upheld by the First Vatican Council of 1870 which

asserted: "If anyone shall say that the one true God, our Creator and Lord, cannot be certainly known by the natural light of human reason through created things: let him be anathema."ⁱⁱ

Even those who still approve of the idea would probably readily admit today that knowledge of God through nature would require not only *reason* but also *faith*. While God may be perceived in nature through reason, that reason cannot be divorced from faith, faith being the appropriate means through which we recognize God in nature. God is not obvious. His presence and reality in nature can only be known through a rational faith or a believing reason.

The question we are raising in this article is: Assuming that God is real (an assumption which is, admittedly, a leap of faith), can He be known rationally by looking at nature? But before we do that, let's first reflect briefly on the historic relationship between science and religion:

II. The Relationship between Theology and the Natural Sciences

The relationship between theology and science has undergone different phases in the past history which can be described like this:

1. *Intertwined*: For some two thousand years or more neither theologians nor natural scientists questioned God as the creator of this world. God was an axiomatic assumption not to be doubted. Even after the scientific approach was introduced around 1500 and the interplay between theory and empiricism was developed (which marked what is called the *modern era*), God continued to be considered the Creator. Newton, Kepler, Galilei and others never called God into question. Theology and Nature remained in union. They were firmly intertwined as one reality.
2. *Opposed*: With the modern era taking full control and moving onto the enlightenment, that union was thwarted. The primacy of the church, and of religion in general, was unseated. At first, God was relegated to a mere deistic God: one who had created the world in some remote past, but then left the world to itself, no longer interfering into its affairs. But as time went on, more and more scientists questioned God altogether and considered the sciences as incompatible with the idea of God. Kopernikus, Darwin and Freud had each given a serious blow to theology. Theology and the natural sciences drifted far apart, and there seemed no reconciliation between the two.
3. *Coexistence*: As theology and the natural sciences drifted apart, scientists developed their new world views while theologians came to a new understanding of God. Although their new understanding of God became increasingly compatible with the new scientific world view, theology and the sciences more or less continued to live side by side without much interfering with each other. They respected their different competencies and their different approaches to reality without really trying to harmonize them. They seldom sought to speak to one another.
4. *Dialogue*: Over the last few decades, however, some theologians started a serious dialogue with interested natural scientists in order to break the virtual non-communication between the two sides and to seek a common understanding of reality. That dialogue has led to some fruitful and mutually enriching results and a rapprochement between theology and the

sciences, enhancing their respective understanding of each other. At times, that dialogue may have been hampered by an elitist language of the theologians, while natural scientists seem, in general, more inclined to make themselves understood by lay people.

5. *Cooperation*: It is only recently that science and theology have begun to cooperate beyond a mere dialogue. Some are beginning to join hands in order to find a common approach to reality. There is a realization that while there may be different aspects of reality or different approaches to reality, in the final analysis there can only be one reality that does not contradict itself. One can only hope that this endeavor to seek a common understanding of reality and a common access to reality will be continued. This paper is an attempt of such a joint venture between a natural scientist and a theologian.

III. Insights from the Dialogue so far

If theologians and the natural scientists want to cooperate with one another for the purpose of better understanding the one and only reality, then both sides need to be aware of the results that the dialogue between them has yielded so far. While it is near impossible to do justice to many years of dialogue, perhaps some basic insights can be briefly described as follows:

1. The natural sciences certainly have dramatically changed the way we as human beings see the world. The old world views of the past had to be replaced by new world views. And we cannot go back to the old ones without losing our credibility and integrity.
2. The natural sciences, while having done much to advance our knowledge, are recognizing that they are more or less limited to what can be empirically investigated, observed, or measured. They are confined to look at the material world. But the natural sciences also recognize that there are vital questions beyond and apart from the natural world, that also require attention and that the natural sciences are not equipped to pursue. Phenomena such as mind, consciousness, spirituality etc. may not be subject to the same kind of empirical investigation as we know it from the natural sciences, but they are conceded as having a reality of their own or constituting different aspects of the one and only reality. The natural sciences are not positioned to deal with questions of religion, theology, philosophy, psychology or sociology. Hence, natural scientists recognize the legitimacy of these other sciences which, obviously, have different assumptions, different methodologies, and different subject matters.
3. Many natural scientists, while being firmly committed to the principles of empirical research, can fully harmonize their scientific endeavor with their faith in an ultimate spiritual or divine reality that they do not consider to be in contradiction with the empirical sciences, but rather as complementing them. Religion, faith and theology continue to have meaning for many natural scientists.
4. A position like that of Richard Dawkins' (see his book *God Delusion*) is considered untenable not only by theologians but also by many natural scientists. Dawkins' position unmasks not only a primitive theism and creationism but also a primitive atheism that does not take stock

of the many years of fruitful dialogue spoken of above. Dawkins and his likes have also overlooked the fact that many theologians have accepted the modern scientific world views.

5. Theologians have accepted not only the modern scientific world view but also the specific competences of natural scientists. They do no longer expect scientists to meet certain religious standards or requirements as in medieval times. While much of scientific knowledge may still be preliminary or tentative, the validity of scientific theories is not subjected to truth criteria outside the scientific community (such as religious or political authorities or a fundamentalist interpretation of Scripture).
6. But theologians do assert a position which allows them to criticize an exclusive empirical, materialistic, positivistic approach to reality. They rightly criticize those natural scientists who give the impression that their approach to reality be the only valid one. Theologians are convinced that there is more to reality than what scientists are finding out empirically. There is wide agreement that the natural sciences tend to be reductionist in nature while there is a great need for an holistic (maximalist) approach to reality. There is certainly more to reality than meets the eye (of the scientist).
7. Theologians, ethicists, philosophers, historicists, anthropologists, ethnologists, sociologists or psychologists (called *Geisteswissenschaftler* in German: scientists of the spirit or of the mind) may be better positioned than natural scientists to address questions regarding the nature of man, the human dilemma, the meaning of life, the problem of suffering, the nature of true happiness, questions of cultures and values, or the principles that should govern human societies.

IV. New World Views and New Theologies

Apart from these general discernments regarding the relationship between theology and science, there are also some important insights which the dialogue between them has yielded in terms of the relationship between the realm of human existence and the realm of the divine, or, to put it more succinctly, regarding the question of God! We would like to enumerate a few:

1. Until about 500 years ago, one of the basic assumptions of mankind was the notion that everything of the here and now was subject to constant change, while heavenly things were everlasting and unchangeable. While our world was considered imperfect and limited, both geographically and chronologically, heavenly things were infinite, unlimited and perfect in every way. Back in those days, the heavens – including the planets, the stars, the Sun – belonged to God's sphere and to the eternal realm. That perception has thoroughly been revised since the modern era and the enlightenment and has been superseded by the notion that everything we see, including the planets, the stars, the Sun, the galaxies and the whole cosmos must be considered part of our empirical world and be considered limited in space and time. In this revised world view, even space and time are limited.
2. From this followed that the former *geography of heaven* is also obsolete. In medieval times, the God of old used to live in the most outer sphere of the celestial realm. There were ten

celestial spheres: the sphere of the moon, the spheres of Mercury, Venus, Sun, Mars, Jupiter, Saturn, then the sphere of the fixed stars, the sphere of the saints and the saved, and finally: the sphere of God the Father. Modern theology does not attribute to God any kind of locality. Rather, God is considered both *transcendent* (i.e. above and beyond this world) and *immanent* (within and throughout this world). He is *transcendent* in the sense that God, while considered real, is nevertheless beyond that which can be seen or perceived through our natural senses. God is nowhere to be seen. He is beyond everything.

3. But God is also considered *immanent* in the sense that He can be perceived in virtually everything about us – if only we have the spiritual sense to recognize Him where others (without faith) do not see Him, according to the saying of Antoine de Saint-Exupéry: *On ne voit bien qu'avec le cœur. L'essentiel est invisible pour les yeux.* (“One sees clearly only with the heart. What is essential is invisible to the eye.”) God can be seen, for instance, in the wonders of nature, in the experience of love and fellowship, in the realization of peace, freedom and justice. He can be seen in wondrous blessings and rescues. He can even be recognized in (and despite) tragic moments of sickness, setbacks, failure, calamity or even death – if only we have eyes to see and a mind that can discern the good in everything. God can be experienced by those who believe in Him.
4. In former times, God was considered the *mover* of things, the cause of everything that existed, but especially of things unexplained or unexplainable. While the principle of *cause and effect* was of course recognized very early on, God was often considered as the one filling in the gaps where humans failed to see a natural cause. God was considered the cause of things which could not be explained naturally. Hence, God was the *God of the Gaps*. But that *God of the Gaps* is now also considered obsolete. With every explanation we can give to heretofore unexplained phenomena, the *God of the Gaps* has lost credibility and become smaller and tinier; and the more phenomena we can explain, the more that *God of the Gaps* is being removed from the world – until He has vanished altogether, and we need not revive Him.
5. The theological notion of God being the *Creator* of the world must be understood not so much in terms of His being the immediate cause of things or of creatures living on earth. Rather, God as the Creator must essentially be understood in a metaphoric sense, having to do primarily with man’s self-understanding and man’s unique identity. When we pray: “You are our Father. We are the clay, you are the potter; we are all the work of your hand” (Is. 46:8), then this is allegorical language. Although man can be said to evolve in a very natural way (both as a species and as an individual), he can also be considered a unique and matchless creature coming from the “hands of God”, as it were, who formed and shaped him and breathed into his nostrils the breath of life so that each of us became a living soul, unlike every other, unique and incomparable, each a wonderful creature in our own right.
6. However, God as the *Creator* can also be understood as constituting (or at least encompassing) the natural laws and principles that govern our universe and without which our world would not be what it is. In this sense, God the Creator is behind everything natural, and everything natural is the outworking of the basic principles that govern any kind of existence; principles that govern the relationship between energy, matter, life, and

consciousness. God, in this sense, is the fountain of life and the foundation of everything that exists. He is the root and reason of the universe. He is the source, cause and purpose of why we exist. He is the mystery behind the question of why there is something and not nothing. In this sense, then, God can be perceived in the natural phenomena of this world. Hence, there *is*, after all, something like a natural theology. We can see God in nature. It is this God that we now turn to in greater detail.

V. God as the Creator, Cause, Source and Force of all Existence

There are, in our view, several possibilities or approaches to recognize God in nature. We could call them “scientific approaches to the question of God”. However, we would immediately admit that none of these approaches provide unequivocal evidence for the existence of God. Whatever we can observe about the workings of nature, such observations will remain subject to interpretation. To conclude that these observations help us to recognize God in nature, remains a matter to faith. There will be those who will not see God where we see Him, and they are certainly entitled to see things their way. God is not evident. We need special glasses to recognize God in nature. These spectacles have exclusively designed lenses with telescopic focal depth: they are glasses of faith. Nevertheless: here are some of the ways in which we believe God may be perceived in nature:

(1) God may be perceived in the universe’s energy

Since time immemorial, humans have adored, even worshiped the Sun. The Sun has rightly been considered the source of light and life. The Sun allows life to live, plants to blossom, animals and humans to find their way around. The Sun has been worshiped by many cultures as one of the gods or even God Himself. Conversely, God has been considered the source of light or even light itself. “God is light and in him is no darkness at all”, says John (1. John 1:5). But light has also been perceived as being independent of the Sun. In the creation story of Genesis, God created the light on the first day of creation. Light is distinguished from the Sun, the moon and the stars which were created only on the fourth day.

We know today that light, as we perceive it, is but a tiny portion of the full electromagnetic radiation spectrum. Electromagnetic radiation, in turn, is only one form of energy as energy can come in different forms (such as gravitational energy, kinetic energy, thermal energy, electric energy, nuclear energy, magnetic energy, mechanical energy etc.), depending on the energy system. Energy can be transformed from one system to another. Energy can also be transformed into matter, as we know from Albert Einstein’s most famous equation ($E=mc^2$). Even a very small particle of matter contains a potentially huge amount of energy. Energy is at the basis of everything we see around us. Without energy, no universe. Energy is what holds the world together, what allows the world to be. Energy is always conserved. Energy can neither be created nor destroyed. It can only be transformed.

In principle, energy is invisible to the eye. But when it is transformed into matter or into the kind of electromagnetic radiation that our eyes can perceive, then energy may be said to become visible. When humans have traditionally attributed divine characteristics to the phenomenon of light, that attribution should really have gone to that primeval energy which is at the foundation of light and matter and life and consciousness.

Energy determines and influences all areas with which science is concerned. Energy is a key factor in astronomy (for stars and their movements, for instance), in geology (for continental drifts), in physics (for nuclear forces), in chemistry (for molecular structures), in biology (for organisms to live) etc. When energy changes from one system to another, that change usually coincides with changes in the system's mass, according to Einstein's relativity theory. While energy comes in many forms and states, the overall amount of energy remains the same. Energy may be said to have eternal qualities.

If God is perceived as energy, then He is what makes the difference between being and non-being, between things visible and invisible. Then God is what lies behind everything, transforming energy from one form to another, from energy to matter and from matter to energy. God is light, but He is more than light. He is in everything we see and in what we do not see. If God is considered the Creator of the universe, then God is in the energy which transforms itself into matter and into life. Energy is the "stuff" from which God created the world.

(2) God may be perceived in the laws of nature

Science has taught us that our universe follows certain principles which we call the *laws of nature*. The laws of nature are the physical foundations of everything that happens in the universe. The laws of nature govern what we investigate in astronomy, physics, chemistry, biology etc. The laws of our universe are such that they allow for the development of galaxies, solar systems, planets, life, animals, humans – and consciousness. So we can say that the laws of nature are of such a kind as to allow for the multifaceted world of wonders that we live in. The laws of nature allow for the greatest miracles we can observe in the natural world. Who would assume, just by looking at the nightly sky, that such an apparently inhospitable universe would contain such wonders as we can observe on earth, wonders like a humming bird or a human baby?

Not all scientists, however, believe in the constancy or immutability of the laws of nature, for two reasons:

(i) Constructivists argue that what we consider the *laws of nature* are simply human descriptions of universal principles. To them, the laws of nature are not discovered but invented.ⁱⁱⁱ Laws of nature to them are not objective facts but only human descriptions of how nature functions. *Objectivity* is a delusion prompted by our belief that observing can be done without the observer.^{iv}

The scientific descriptions we call *laws of nature* are only true within a given range of experience but not necessarily outside that range. For instance, the Newtonian laws certainly apply to a wide range of circumstances, but outside those circumstances these laws may no longer describe the workings of nature. It is for this reason that Albert Einstein had to develop his theory of relativity, a theory which applied to a larger context than Newton's perceived reality. But even Einstein's theory of relativity does not apply everywhere – at least not within the subatomic world. It is here where quantum theory comes in. Both theories are limited in their own way and cannot be said to be universally applicable. The world may unfold its secrets at the points where our constructions fail. For that reason cosmologists are looking for a theory called *quantum gravity* which, if ever formulated, might apply everywhere in the universe. So what we normally call the *laws of nature* are just scientific descriptions of how nature functions.

Maybe the problem is only a matter of definition. If by the *laws of nature* we primarily think of those human theories (Newton's law of gravity, Einstein's theory of relativity or Heisenberg's quantum theory) which describe in mathematical terms what we observe in nature, then these laws may be said to have been *invented*. But if by the *laws of nature* we mean the principles according to which the universe functions – regardless of the way scientists have described them – then the laws of nature may be said to have been *discovered*. If discovered, they can continue to be called the *laws of nature*; if invented, they had better be called the *laws of science*. Laws of science would be human constructs, laws of nature would apply everywhere and at all times across the universe and would exist regardless of scientists understanding or describing them.

(ii) There is a second, more important reason for questioning the constancy and universality of the laws of nature. Cosmologists aren't really sure why the laws of nature are the way they are. There seem to be no plausible reasons why they could not have been different from what they are. In fact, given different initial conditions at the early stage of the universe, the laws of nature today might be quite different. Only if and when the laws of nature are what they are (as in our universe), would they allow for life to exist. This may be called the anthropic principle. So-called creationists would argue that that is proof of God. But modern cosmologists believe that our universe might not be the only universe there is. In fact, some cosmological theories actually require multiple universes. The concept of multiple universes is not far-fetched. Just as there are many other galaxies apart from our own Milky Way, so there may be different universes apart from our own cosmos. And in those other universes the laws of nature would probably differ from our own. Where they differ, chances of life would be rather dim.

Will we ever know about other universes? Probably not, for no scientist is likely to be able to ever look beyond our own universe. And whatever the truth about multiple universes, we can assume that the rules or principles which decide over what kind of laws would apply in which universe are probably applicable across all universes.

In any case, in our universe – and for the time being, this is the only one that we will know of – things function according to a set of laws or principles which presumably apply all across the universe. It is these laws (not their scientific descriptions of them) which govern everything, from the smallest nuclear particle to the largest molecules to living organisms and even including the human brain. These laws are not only subject to the principle of cause and effect but also subject to the quantum principle of contingency.

If God, then, is the Creator of the universe, then certainly the laws of nature would constitute the substance from which He may be said to have created the universe and all that it contains: galaxies, stars, planets, plants, animals, humans and the mind. If God is all and in all, then the laws of nature provide the structure and the building blocks for holding everything together and making it work for the whole. God may be understood as representing or constituting the universal laws of nature.

(3) God may be perceived in the creative potential of the universe

Given the laws of nature, these laws did not of necessity lead to life, consciousness or any useful idea. They may have provided the preconditions to life, but there was no inescapable inevitability that they would lead to it. Life is contingent. Life, consciousness, ideas, art, music, a poem – they are

not inevitable. They are only possible. They do exist, but they may just as well not have been. The contingency of life entails its non-existence as well as its existence. Nothing in this world is bound to happen. Everything that exists is like an undeserved gift, a wonder not to be taken for granted. Life is chance. The very fact, however, that we can observe life and all its wondrous realities proves, beyond a shadow of a doubt (!), that in that very early beginning (may it have been a Big Bang 14 billion years ago, as we believe, or some other inconspicuous commencement) there was this enormous *potential* for bringing about the greatest wonders that we can see today.

We never cease to wonder when we find little plants sprouting from tiny cracks between rocks or from tiles on the roof or from giant cliffs where one would never expect something to grow at all. It seems life finds its way into existence against all odds. Organic life is dormant in what only appears to be inorganic matter. As all of life eventually turns to dust, so dust seems to have an inherent potential and even a yearning for life. We agree with Görnitz/Görnitz who believe that life is to be found wherever it is not absolutely impossible to exist.^v So even when there was no life as yet, there was nevertheless great potential for it.

In that early beginning of the universe there was a latent capacity for everything that existed in the past, exists today and will exist in the future. That early beginning was full of incredible power and inherent creativity. If there had been an observer to watch the Big Bang, that observer would not for one minute have imagined the kind of wonders that eventually would find their way into existence. That singularity had gigantic potential.

In fact, if it is true, as some new cosmological theories go, that the universe came not only from an infinitesimally small singularity but even from a spontaneous quantum fluctuation in a vacuum just a fraction of a second earlier, then one may attribute that enormous creative potential from which galaxies, stars and planets grew, to that mysterious vacuum. Then there is nothing more powerful and creative than nothingness. Then God may indeed be said to have created the world *ex nihilo*.

We have said earlier that God can be understood as the totality of reality or, with a different word: as the whole. But reality involves possibility. They are two sides of the same coin. They presuppose each other. Reality presupposes possibility, for nothing is real that was not possible. But possibility also presupposes reality. What cannot become reality, cannot be said to be possible. So if God is the whole, then He is not only *reality* but primarily *possibility*. He is creativity. If God is the Creator of all, then He is the foundation of everything there is. God is not only in everything we see today but He was also in the vacuum that existed before the Big Bang. God was before everything else and will be after everything else. God is the huge creative potential of the universe.

(4) God may be perceived in the concept of "information"

The concept of *information* is very basic not only to the universe as a whole but also to all matter and all life. To understand this, let's begin by looking at the foundation of physics. In the 20th century, physicists hunted for the smallest of all particles. They first discovered atoms, then broke atoms down into the atomic nucleus and the more ephemeral electrons. In looking at the nucleus, they discovered protons and neutrons. Subsequently, they learned that the world of elementary particles consists of quarks and leptons. These are of different types and together they constitute what is called the *Standard Model* of particle physics. If the still elusive Higgs particle is found at CERN's

Large Hadron Collider (LHC) – and there are indications that the experiments have already detected the Higgs particle – then the Standard Model can be said to have been conclusively verified. But the question is: can quarks and leptons be further subdivided? The answer physicists are giving is twofold: For one, it is theoretically assumed that there can be nothing smaller than a *Planck unit* or a *Planck length*. Planck units are calculated on the basis of five universal constants,^{vi} and they are infinitesimally small.

For another, it has been suggested that what lies at the very foundation of all particle physics is what has been termed *binary quantum information* or *qubit*. Qubits are basic alternatives. That has to do with the nature of quantum physics which includes the concept of *quantum nonlocality* which, in turn, implies that on the particle level you can predict either the *position* or the *momentum* of a particle but not both. That characteristic is one of the most bizarre features of quantum mechanics, which led Albert Einstein to question it by saying: “God does not throw dice”. Einstein was proved wrong. God does throw dice which in non-theological terms means that the strong principle of determinism assumed by classical physics had to be abandoned. Quantum theory tells us that there is no uninterrupted succession of cause and effect but that there may be phenomena which are, at least in principle, unpredictable, or in other words: they are subject to chance. Quantum theory has re-introduced objective chance into physics.

The term *information* has been criticized in this context as *information* normally implies *meaning* and is exchanged between two communicators. However, *quantum information* does not imply meaning as meaning is something to be imputed only by the human mind, and the human mind is not involved here. Hence, the term *protyposis* has been suggested instead quantum information.^{vii} But whatever it may be called, the concept means that everything that exists can ultimately be reduced to information in the sense of binary alternatives. It is like a computer: every software we use, all the websites we look at, and all the games we play – they can all be reduced to binary alternatives. These binary alternatives of quantum theory, however, are determined partly by cause and effect and partly by chance. Quantum information, according to the quantum physicist Thomas Görnitz, is as real as matter or energy, as it can affect both.^{viii}

Quantum information may be said to hold the secrets of everything that exists. It stands for every potentiality, for anything new that emerges from what was before. Quantum information is the universe’s creative potential, the foundation of microcosmos and macrocosmos, the driving force of creation, the interface between being and non-being.

According to physicists and cosmologists, information is never lost. The cosmologist Leonard Susskind speaks of *information conservation*. “Information is forever”, he says.^{ix} Information may be expressed in many different ways, as energy or matter, but it will never alter its basic quantity. This principle is sometimes called the *law of reversibility*. Because this law is so basic to all physics, it was like a virtual coup d’état when Stephen Hawking announced that information was lost from a Black Hole. Susskind was appalled. For years, he and others fought Hawking’s proposed information loss – until Hawking rescinded from his position in 2004. Information conservation still stands.

Information is the basis of all physics, chemistry, and biology. Information, although in its most basic form consisting only of binary alternatives, is translated into different forms and different vehicles of transportation. Acoustic waves, for instance, carry the information about sounds, words or music. Electromagnetic waves carry information about matter or energy. Such waves, when hitting the

retina of the eye, give us information about distant objects such as plants or planets. Paper can carry written information about all sorts of things such as the kind of stuff you are reading here.

A special kind of information is what is contained in the genes. The genetic code carries the genetic information responsible for the specific type of cells to be produced or the particular species to mature. Genetic information is written and stored using a molecular language with four different molecules on the DNA double helix structure. That genetic information is preserved while being passed on from one generation to the next. Except for minor changes through recombination or mutation, that genetic information is conserved and passed on through millions of years. Although carriers of that information (such as ourselves) may die, the information lives on. Information is preserved, is creative, is essential for life.

God can be perceived as information. God is the basis of everything. Everything that is, has come to be through information. Everything that is can be traced back to binary alternatives that at one time or another were decided this way or that way. While there is no loss of information, information being eternal, as it were, information is translated into different forms and shapes. Information can be energy or matter, matter or life, subconscious or conscious, seemingly meaningless or meaningful. Information can be said to have an existence or it can simply be considered potentiality. God may be said to be all that. Information is tantamount to potentiality.

(5) God may be perceived in the teleological thrust of evolution

There is agreement amongst biologists that evolution is more or less non-directive. That is to say that evolution has no predetermined end-results. It has no pre-described goal. Biological evolution is determined not by a target or objective but simply by the impulse for survival. Evolution is the survival of the fittest. Those species will survive that are best adapted to the environment in which they live. If there is any purpose or goal to speak of, then it is the urge of all living creatures for survival. Those who do not have that impulse will soon die out. That's why most of us humans, too, have an innate craving for life and survival. It would be an aberration of life if that craving were lacking. But apart from the impulse for survival, there seems to be no definite teleological direction into which evolution is heading. Or is there?

Yes, there is! Let's explain:

Survival presupposes fitness, as Darwin called it. Fitness means good adaptation to the environment. Better adaptation becomes possible through mechanisms such as *mutation* (spontaneous changes in the genetic structures), *recombination* (re-arrangements of the genes through sexual reproduction), *epigenetic changes* (activation of certain genes to improve overall fitness without actually changing the genetic structure) and *selection* (the sorting out of the weak and poorly adapted). All these mechanisms work together to make living creatures more adaptive to their environment and, hence, fitter for survival. The more a species adapts to the environment, develops protective devices to fend off predators or learns to hunt for food efficiently, the more chances it will have to win the fight for existence against the odds and a multitude of competitors. Evolution has found a way to develop efficient techniques for perceiving the environment, taking in food, running fast, climbing high, flying away, swimming long distances, ensuring reproduction, escaping from dangers etc. In doing so, evolution has perfected these biological mechanisms over millions of years. So while we cannot

observe a definite and predictable direction that evolution takes, we can – at least in hindsight – observe a general trend into the direction of improved senses, improved metabolisms, improved food intake, improved leg movements, improved body shapes, and improved brain capacities. So we can observe a *general teleological direction* of evolution.

There is, in evolution, what is called *convergence*. Convergent evolution is the development of analogous structures, traits, and shapes that have evolved by very different species along very different development routes but which show great similarity and which appear to be well suited for survival within a given environment. Convergence demonstrates teleological direction.

There are numerous examples of convergent evolution. We find convergent traits in mammals, reptiles, birds, fish and others. One example of convergent evolution is the *wing* that has developed in species quite unrelated to each other, such as birds and bats. Another example is the *eye* which has been developed more than once in the history of biology, along different routes. A different example of convergence is the Australian Koala which has developed *fingerprints* virtually indistinguishable from humans. Another famous example is the long extinct *ichthyosaurus* which has almost the same shape as the still extant *dolphin*. While the ichthyosaurus was related to reptiles, the dolphin, being a mammal, is more related to a dog than to the ichthyosaurus – despite their twin-like similarities. Along very different routes, these two species developed into almost the same “end product” because of the same environment in which they lived – the ocean. It was the environment which forced them to develop efficient body shapes that helped them to survive.

So convergence shows that the environment and the evolutionary mechanisms work together to drive evolution forward into a general teleological direction. It is like boarding a sailing vessel at Lisbon and heading west. You might not predict the exact port of disembarkation, but if you constantly keep heading west, you will eventually arrive somewhere in the Americas. Or, to use a different example, if you have a mountain range with a number of different slopes and you allow a sphere to roll down one side, you may not predict the exact route the sphere will take, but you can certainly predict the general direction into which the sphere will roll, and you can be sure that it will come to rest in one of the adjacent valleys.

One of the ways in which evolution has improved adaptation is the development and steady improvement of neural networks. A nervous system, with its brain as the “central control station”, allows living creatures to receive, process and interpret sensory information, to fend off dangers, brace for combat, and to grasp opportunities for catching prey. We can say that senses, the neural system and the ability to think logically, are all part and parcel of a “teleological survival package”. Given enough time, they do eventually develop. If humans had not developed the way they have, then something very akin to humans might have developed. We could call this tendency a *teleological drift*, and biologist have spoken of *evolutionary drift* or *natural drift*.

If God is considered the Creator, then His creativeness can be said to reveal itself in this teleological tendency or evolutionary drift towards improved adaptation, improved sensory abilities, and even the development of consciousness. At the onset of evolution, no one could have predicted the final results of that development process, but in hindsight, one can conclude that the most complex and most efficient biological systems – including the ability to think and reason – were already contained, as latent potentiality, in the very earliest primitive cells of life and maybe even in the inorganic matter from which life sprang up in the first place. If God is the foundation of all existence, if He is

the potentiality from which emerges all reality, then He can be seen in the teleological thrust of evolution.

(6) God may be perceived in the principle of resonance

The idea of a *resonance theory* goes back to the late Friedrich Cramer, a German chemist who proposed that oscillating systems can, under certain conditions, resonate with each other. Resonance creates wholeness, Cramer proposed. If you touch several keys on the piano you hear several tones that create an acoustic whole. But resonance is not confined to music or acoustics. It holds for all oscillating systems: atoms, molecules, organs, organisms, persons (*per-sonare!*), societies etc.^x

Resonance is what holds everything together – from the smallest elementary particles to the whole of the universe. It holds together mind and matter, relationships and societies. In fact, there is virtually nothing in the world that will be completely isolated or independent from other things. In the final analysis, everything resonates with each other. One only needs to think of the most distant galaxies and stars: By way of gravity they all influence each other and resonate with one another.

Resonance is a term originally borrowed from music and having to do with the vibrations which a sound (tone) emits, thereby evoking certain reverberations from its surroundings. Several tones can resonate with each other to create harmony – or disharmony. Resonance happens when vibrations or oscillations meet each other, cross each other, interfere with one another or swing with each other. These vibrations or waves are physical phenomena that can be acoustic, mechanical, electrical, magnetic electromagnetic etc.

A good example of resonance is a swing. If you push a child sitting on a swing in tune with the way the child swings, then the swing (which functions like a pendulum) will oscillate even more – possibly to the point of endangering the child. If two vibrating systems amplify each other, they can cause violently swaying motions up to the point of overstressing the whole system. If, on the other hand, you push the child contrary to his or her movements, then the swing will soon come to a halt or, worse yet, you will fiercely collide with the child.

If two oscillating systems interfere with each other, they will alter or even destroy their respective movements (waves or oscillations). Such interference can create interference patterns as we see them in the famous double-slit experiment or when we throw two different stones into a pond so that their respective waves cross each other, sometimes increasing the crest, sometimes increasing the valleys, sometimes neutralizing each other. Different vibrations will sometimes amplify each other, and at other times cancel each other out. Stable systems have resonances which are balanced, unstable systems have unbalanced resonances: Most solar systems or galactic systems are fairly stable, but some systems oscillate too much to allow for life on their planets.

The world vibrates. There are waves everywhere: acoustic waves, water waves, seismographic waves, electromagnetic waves: They all resonate with each other in some way. We can also speak of circular systems or cycles: life cycles, hormonal systems, neural systems, seasonal cycles. All these resonate with each other, amplifying each other, cancelling each other out, depending on each other, co-habiting with each other. There are natural cycles as well as cultural and social cycles: traffic systems, train systems, financial systems, stock markets. Some of these systems enter

symbiotic relationships in which several cycles revolve within each other, interplaying with each other in mutual reciprocity. They resonate with each other.

If God is a reality, then that reality may be seen in what we call resonance. Resonance makes the world go round. Resonance is what holds the world together. Our world never stops to a halt. There is no such thing as everlasting permanence. Everything is moving: cycles, spins, rotations, revolving systems, reverberations, oscillations. There is resonance or interplay between the micro cosmos and the macro cosmos, between chaos and order, chance and determinism, necessity and contingency, matter and spirit, space and time, reality and possibility, meaning and meaninglessness, life and death, death and life, non-being and being. Resonance is what allows societies to function, companies to be successful, relationships to blossom. Resonance is what brought the world into existence. God resonates with the world. And the world resonates with God. Or better yet: God *is* resonance. God is what holds the world together.

One important experience of resonance is the interdependence that occurs when two human individuals of opposite gender enter a relationship of resonance that we call *love*. Love is the ultimate resonance. Man cannot live without the resonance of love. Friedrich Cramer ends his book on resonance with a poem of love. Love makes the world go round. That's why we say: God is love. And God is "over all and through all and in all" (Ephesians 4:6).

(7) God may be perceived in the phenomenon of complexity

The phenomenon of complexity is on the edge between chaos and order. If things were in absolutely perfect order and would follow perfectly predictable rules, then nothing new could emerge. If, on the other hand, things were in absolute chaos and in total disorder and there were no obeying of any rules, then there would be no constancy, permanence or predictability. Life could not emerge or survive in a state of constant chaos or a state of absolute order. Life is on the edge between chaos and order. And that edge may be called *complexity*. Complexity is a relatively new science (*complex systems theory*) which touches upon such areas as *chaos theory*, *systems theory*, *cybernetics*, *self-organization theory*, *social systems theory*, *fractal geometry* and other related fields.

For the most part, the pursuit of science has been reductionist. That means that we have broken down complex things (like a frog, for instance) into its parts, thinking that if we can name the parts and understand their functions, we have understood the whole. However, as soon as you start dissecting a frog, you destroy the frog's life and certainly cannot learn what gives life to the frog. But that's the way we have pursuit science. The physicist's rat race of hunting for ever smaller elementary particles (like leptons or quarks) was stimulated by the idea that if you reduce the object of interest to its smallest possible component, then you have understood everything.

But nothing could be further from the truth. It is an illusion to think that if you can give names to the parts and understand their functions, you understand the whole. The whole is more than the sum of its parts. The whole is complex. And it is only through its complexity that we can hope to understand the whole, if that is at all possible. The only way to understand things fully is when you have understood the relationship between the smallest and the largest. Perhaps, the only appropriate reaction to complex systems is awe and wonder.

To say that complexity is on the edge between chaos and order requires us to understand both. Order is characterized by structure, form, organization, patterns, identifiable components, repetition, predictability, and it usually can be attributed to cause and effect. Chaos, on the contrary, is seemingly unstructured, without form or organization, non-predictable. While causes and their effects may not be identifiable in a chaotic system, they nevertheless are at work in a chaos, but in such a complex way as to make predictions impossible. From the fractal geometry we have learned that even the most chaotic systems eventually give rise to ordered structures and creative designs that even seem to suggest a designer or creator. The relationship between chaos and order is what chaos theory is all about.

Chaos theory looks at how very simple things can generate very complex – seemingly chaotic – systems that in turn create new order and new simplicity. If you take a fish as a small, simple entity and add to it other fish until they form a school or swarm, then you have a complex system. You will wonder about the *behavior* of the swarm as that *behavior* appears to have a personality all of its own. There seems to be a leader, director or designer organizing the swarm. But there is none. In reality, the swarm and its “personality” is the result of many fish behaving according to a set of very simple rules, such as: (i) swim along the average route of direction that most of your neighbors take; (ii) keep a fairly equal distance from those next to you; (iii) avoid any dangerous object or animal. The swarm has no director but lives from a combination of the need for self-protection and a desire for social cohesion. As a whole, the swarm is a complex system that appears to be chaotic and unpredictable but obeys very simple rules.

Complexity, being on the edge of chaos and order, can give rise to new things, provided there is a balance between chaos and order. If there is too much chaos, there won't be enough structure for something new; everything is just topsy-turvy and nothing new can evolve. If there is too much order, on the other hand, then things are too structured, too simple, too bland for anything new and creative to emerge. It is the *edge* between chaos and order that can give rise to something new. It is this edge of complexity that holds the magic and from which emerges the unimaginable.

If God is the Creator, if He is the one who gives rise to new, unimaginable, complex things and living beings, then it is in this complexity on the edge between order and chaos where He may be perceived. If God is more than reality but also possibility, then it is complexity where possibility turns to reality. Possibility gives rise to reality, and reality gives rise to new possibilities. God is on the edge. It's the edge between non-being and being.

(8) God may be perceived in the emergence of consciousness

On a mere biological level, consciousness – or the mind – is the result of evolution. It results from a vigorous fight for survival in which the senses and the nervous systems have played an important part. Consciousness – the ability to manage sensory perceptions, to make sense of what the senses tell us, to think up ways of responding to danger and opportunities – can be considered to be the ultimate pinnacle of evolution's manifold wonders.

We already spoke of the teleological thrust of evolution, i.e. the tendency of evolution to develop ever more sophisticated traits that help living beings to survive and that drive evolution forward. That teleological thrust implies that while evolution is not predetermined in every way, it is of

necessity directed towards ever more efficient and more complex^{xi} organisms, including the brain and the consciousness that goes along with it. Many animals have efficient neural networks, and some may work better than others. The human mind is considered to be the most sophisticated brain there is, with the human ability to reflect upon oneself, to think of the past and to anticipate the future. Based on the teleological thrust, we can say that evolution is oriented towards consciousness. Cosmic development is geared to create life, and life is geared to develop consciousness.

Consciousness, in the human form as we know it best, has a number of unique characteristics. Among them is the ability to be conscious of a Self. That “self-consciousness” or “self-reflection” includes an awareness of the continuity of the self from childhood to old age despite the obvious changes a person undergoes throughout his or her lifetime. Another characteristic of human consciousness is *subjectivity* – the ability to distinguish oneself from others, and the awareness of one’s own subjective (if not to say, selfish) view that takes priority over other people’s perspectives. Human consciousness is, in principle at least, subjective. Whatever a subject experiences unlocks itself primarily and almost exclusively to the subject having that experience.

Another characteristic of consciousness is that while it is of course dependent on the brain’s *hardware* (cells, neurons, dendrites, axons, neurotransmitters, receptors, synapses etc.), it takes on a quality of its own seemingly independent of the hardware. When a human thinks up a poem or a melody, that piece of art cannot be predicted on the basis of the particular physiological hardware. Consciousness has a reality and creativity all of its own. Consciousness takes on an ephemeral, elusive, and intangible quality which we have tried to describe with words like *mind, intellect, thinking, reason, logic, spirit, ghost, soul, psyche, awareness* etc.

Consciousness, as we describe it here, is closely related to sub-consciousness. Most of the bodily functions are not directed by our consciousness but by subconscious and involuntary physiological processes. The functionality of metabolism, for instance, happens without our conscious participation (except for the intake of food and drinks). Consciousness is only the visible part of the iceberg. The Subconscious is below the water surface (we might call the whole iceberg *mind* or *spirit*.) The conscious mind and the subconscious mind work together for the good of the whole being. But the greater part of it is beneath the demarcation line between consciousness and sub-consciousness. The two depend on each other, work together, and constantly influence each other. When we drive a car or play the piano, most of what we do we do subconsciously, even though we consciously decide where to drive the car to or which piece of music we choose to play. Human creativity is a combination of consciousness and sub-consciousness, and the more we allow sub-consciousness to take control, the more creative we might be. The *mind*, the *spirit*, that ephemeral, elusive wonder, is a most powerful and creative phenomenon.

Some will ask the question: is consciousness, as we know it, the mere end-result of the biological development process, the peak of evolution, so to speak? Or is consciousness not rather something that existed before everything else? Is matter and life oriented towards consciousness? Or is consciousness oriented towards matter and life? Are humans the result of an upwards process – from unorganic matter to organic life to consciousness? Or are they not rather the result of a downward process – from consciousness to matter and to biology (in which case we could call this downward process *incarnation*)?

Andrei Linde, a Russian cosmologist at Stanford, was once asked to address that very question. Linde is not suspected to have fundamentalist ideas about God or about Buddhist consciousness. In fact he is one of those cosmologists theorizing about a universe that created itself out of nothing (i.e. from a quantum fluctuation in a vacuum). As a quantum theorist, Linde knows that within the quantum world, a quantum state becomes a stable reality only when there is an observer. “Without introducing an observer, we have a dead universe, which does not evolve in time.”^{xii} Linde then wonders if “our knowledge of the world begins not with matter but with perceptions”. And then he asks: “What if our perceptions are as real (or maybe, in a certain sense, even more real) than material objects?”^{xiii} Is it possible, so he asks, “that consciousness may exist by itself, even in the absence of matter, just like gravitational waves, excitations of space, may exist in the absence of protons and electrons?”^{xiv} And “could it not be that consciousness is an equally important part of the consistent picture of our world, despite the fact that so far one could safely ignore it in the description of the well studied physical processes? Will it not turn out, with the further development of science, that the study of the universe and the study of consciousness are inseparably linked, and that ultimate progress in the one will be impossible without progress in the other?”^{xv}

Linde just raised those questions without actually giving answers or claiming to know the answers. Neither will we try to answer those questions. But what we are suggesting here is that if God is to be considered the Creator, then He may be perceived in the phenomenon of consciousness. It is in this consciousness that His creativity is most conspicuous, most obvious, most evident. It was probably because of this consciousness that the Hebrew people of old believed to have been created “in the image of God”. God’s consciousness and man’s consciousness may be considered as being of one substance. Where else would we find, on earth, the reality of God, who is said to be “Spirit” (John 4:24) if not in the spirit of man?

V. Conclusion

We have made an attempt, in this article, of reviving the old concept of *natural theology*. Based upon the findings of an extensive dialogue between religion and science, we have suggested that God can be perceived as Creator in such natural phenomena as the universe’s energy, the laws of nature, the creative potential of the universe, the concept of information, the teleological thrust of evolution, the principle of resonance, the phenomenon of complexity, and the emergence of consciousness.

We do not believe that the notion of perceiving God in these phenomena is so compelling or indisputable as to justify an *anathema* for those who cannot thus perceive God in nature, as formulated by the First Vatican Council. God is not self-evident, and His presence in nature is not subject to scientific proof. However, assuming that God is a reality, or rather: assuming that God IS reality, then His reality can be perceived in nature through faith.

There are some who will say that these perceptions of God in nature, as we have here described them, make sense only if and when there is an actual God behind nature who has purposely designed nature in such a way as to prompt us to perceive Him in this way. If there were no God *beyond* nature, so they think, then the notion of perceiving Him *in* nature does not make sense and is nothing but theological hogwash. To these people, God is the mover, the cause, the force behind the world’s energy and creative drive, He is the power and designer behind the teleological thrust, He is the divine consciousness prompting and creating matter, life, and consciousness. Without Him there

would not be anything that is. They ask: Why try to perceive God in nature when there is no actual God to speak of outside of nature? There must be a transcendent God.

There are others, however, who will argue that it does not matter whether or not there is a God existing on the other side of nature – as long as we are ready and willing to accept God's reality this side of nature. God is not behind the natural laws and the energy and the resonance and life and consciousness, rather: He is *in* them. To them, to postulate a God entirely remote from the world and from us and from nature does not make much sense because the only reality of God that we can be concerned with is the God who reveals Himself to man through faith and whose power we experience only by assuming His presence this side of nature, or to be even more pointed: the only God we must reckon with is the God who is a reality in our own lives. God must be immanent.

Can we harmonize these two opposing viewpoints? Is there any way of knowing who is right? We think not. Rather, we must accept the fact that we will never be able to ascertain whether or not there is a God on the other side of nature. And there is no use trying to find out because it is not possible for us to investigate anything beyond nature. There is no scientific – or even epistemological – method of knowing for certain whether or not there is a God (or a divine consciousness or whatever we choose to call it) that is outside, before, or after nature. If there is, such a God will forever be elusive to us. We cannot prove that kind of God. We can only believe in the reality of the God who has revealed Himself to man's faith through the medium of nature. Or, to say it in terms of Christian theology: We can only believe in the God who has revealed Himself in this world through the medium of *love*. Love is the only proof of God.

ⁱ Kant wrote: "Dieses moralische Argument soll keinen *objektiv*-gültigen Beweis vom Dasein Gottes an die Hand geben, nicht dem Zweifelgläubigen beweisen, dass ein Gott sei; sondern dass, wenn er moralisch konsequent denken will, er die Annehmung dieses Satzes unter die Maximen seiner praktischen Vernunft *aufnehmen* müsse. – Es soll damit auch nicht gesagt werden: es ist *zur Sittlichkeit* notwendig, die Glückseligkeit aller vernünftigen Weltwesen gemäß ihrer Moralität anzunehmen; sondern: es ist *durch sie* notwendig. Mithin ist es ein *subjektiv*, für moralische Wesen, hinreichendes Argument." See: Immanuel Kant, *Kritik der Urteilskraft*, in: Werke in sechs Bänden, ed. by Wilhelm Weischedel, Vol. VI, Darmstadt 1983, S. 611. See also: <http://www.ac-nice.fr/philo/textes/Kant-KritikUrteilstkraft.htm>

ⁱⁱ *Dei Filius*, The Dogmatic Constitution of the First Vatican Council, 1970, Canon II,1.

ⁱⁱⁱ Heinz von Foerster: „Entdecken oder Erfinden. Wie lässt sich Verstehen verstehen?“, in: *Einführung in den Konstruktivismus*, Piper: München 1992, S. 41ff.

^{iv} According to Heinz von Foerster, objectivity „is the cognitive version of the physiological blindspot: we do not see what we do not see. Objectivity is a subject's delusion that observing can be done without him.“ Zitiert nach: Peter M. Heil: "Konstruktion der sozialen Konstruktion. Grundlinien einer konstruktivistischen Sozialtheorie", in: *Einführung in den Konstruktivismus*, Piper: München 1992, S. 109 (Fußnote 1).

^v Görnitz u. Görnitz, *Der kreative Kosmos*, S. 27.

^{vi} These are: the speed of light (c), the gravitational constant (G), the reduced Planck constant, the Coulomb constant, and the Boltzmann constant. The Planck unit determines not only the smallest size (Planck length), but also the smallest units of mass, time, electric charge, and temperature (Planck mass, Planck time, Planck charge, and Planck temperature).

^{vii} For extensive discussion on *quantum information* or *protyposis* see: Thomas Görnitz u. Brigitte Görnitz: *Die Evolution des Geistigen. Quantenphysik – Bewusstsein – Religion*, Vandenhoeck & Ruprecht: Göttingen 2009.

^{viii} Dies.: *Der kreative Kosmos. Geist und Materie aus Quanteninformation*, Spektrum/Elsevier: München 2007, S. 119.

^{ix} Leonard Susskind: *The Black Hole War*, Back Bay Books: New York 2008, S. 180.

^x Friedrich Cramer: *Symphonie des Lebendigen. Versuch einer allgemeinen Resonanztheorie*, Insel Taschenbuch: Frankfurt/Man und Leipzig 1996/98, S. 9.

^{xi} However, the wonders of creation show themselves not only in evolution's ability to develop ever more complex organs and organisms, but also in its capacity to simplify complex systems, thereby making them more efficient.

^{xii} Andrei Linde: „Inflation, Quantum Cosmology and the Anthropic Principle“, in: *Science and Ultimate Reality: From Quantum to Cosmos*, honoring John Wheeler's 90th birthday, edited by J. D. Barrow, P.C.W. Davies, & C.L. Harper eds. Cambridge University Press (2003), p. 25 (of the unpublished paper)

^{xiii} Ebd., S. 27.

^{xiv} Ebd.

^{xv} Ebd.