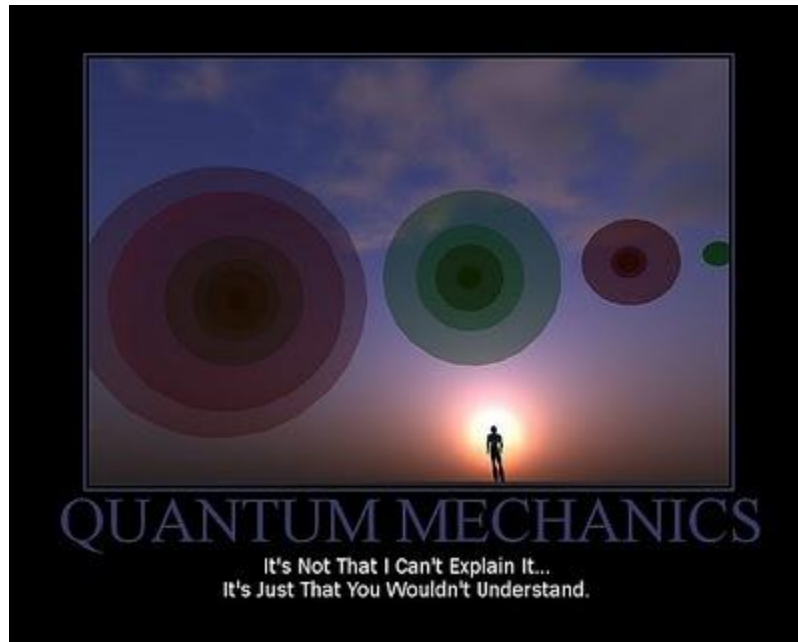


Quantum Mechanics, Orthodoxy and Faith



"As If" or "I Believe": Models for the Seen, and for the Unseeable by Fr. Paul A. Koroluk

Man Communicates Through Models

We humans share with each other the world we live in. In fact, we share it not just with those here today, but also with those who came before us and those who will come after us, and we communicate so that we share not just the same space, but also our observations and experiences.

The most direct way to share something we have seen, done, or felt is simply to make it possible for another person to have the same experience. If, for example, I wish to share a view that I thought was beautiful or moving, I could bring another person to the same place so that they would see the same view. If what I wanted to share was a small object, I could bring the object to them. However, communication limited to only these direct means would be extremely limited. We would only be able to share observations with those very near us, and those whose lives overlapped ours. Importantly, how could we communicate our emotions or our desires? We could not.

Man eventually learned to communicate in the abstract, to use models to represent the world. We were no longer limited to bringing an apple from the tree or bringing another person to the apple tree, we could pantomime eating an apple and rub our tummies while smiling to communicate the thought of "delicious"; we could draw a two-dimensional map to show where the tree was; we could create a portrait of the tree. We could paint not just a portrait of the tree and its environs, but we could choose the angle, the shading, and the highlighting to communicate a particular emotion that we felt. When we do this, we do not create a new tree; we create a model of the tree.

All of these tools, painting, art, cartography, pantomime, are really ways of modeling, of creating an expression of an object that would be understood by others and allow us to share with them, to communicate to them, feelings and abstract thoughts. As our modeling tools developed, the level of abstraction we could communicate increased. Because our thoughts could now be transported further and passed forward through time, we were able to build on each other's thoughts.

Now, because we have communicated for so long, it is easy for us to forget that we are using models, and, when modeling the world we share, it is easy to forget that the cosmos is there and we are in it; changing our model can change our perception of the universe, but will not change the universe itself. We can argue about how to model the universe, but cannot argue the universe into being something that it is not. We own the models, but not the universe.

The Language of Science

"...a uniformly dense spherical shell attracts an external mass point as if all its mass were concentrated at its center." Sir Isaac Newton

"radiation...behaves thermodynamically as if it consisted of mutually independent energy quanta..." Albert Einstein

Whether or not it is explicitly stated, it is implied in all scientific theories that the model proposed, be it linguistic, mathematical, or abstract, is a relationship or comparison. Each model is a proposal for looking at some aspect of our universe "as if" it were something simpler, so that the model can be used to predict or interpolate a real, an observable and measurable, event.

When discussing scientific models, it is common to speak of a particular model as being "correct" or "wrong", or to speak of a problem as "solved" or "unsolved", but this is really just a shorthand way of speaking. What is really meant by a problem being "solved" is that we have developed an understandable model to communicate that aspect of nature, and when we say a model is "correct", what we really mean is that the model is "useful", that predictions with this model are accurate.

In fact, science readily embraces models that are contradictory or misleading. We can look, for example, at light. Is light a wave? Is light a particle? This set of questions has driven centuries of physical studies, and is at the heart of the entire field of quantum physics. Sometimes, modeling light as a wave is more useful, the wave model provides accurate predictions; sometimes the particle model is more useful; light in some ways acts as if it were a particle. Both models can be proven false, that is, it can be shown for both models that they will make false predictions when their use is not limited. Still, we continue to teach and use both models because each is useful under certain circumstances.

In another example, the model of the atom developed by Niels Bohr, showing electrons spinning, like planets, around a nuclear core, is still taught around the world, even though we know that, whatever and wherever electrons may be, they are not distinct little planets in distinct little orbits. The Bohr model presents an inaccurate picture, but it is still taught because it is relatively simple to envision and makes accurate predictions and is, therefore, useful.

Science begins with an analogy, an "as if", tests it, and then continues to use it as long as doing so brings some reward.

Beyond Science

"It would be possible to describe everything scientifically, but it would make no sense; it would be without meaning, as if you described a Beethoven symphony as a variation of wave pressure." Albert Einstein

"I am very astonished that the scientific picture of the real world around me is very deficient. It gives us a lot of factual information, puts all of our experience in a magnificently consistent order but it is ghastly silent about all and sundry that is really near to our heart, that really matters to us." Erwin Schrodinger

By strictly insisting on usefulness, by insisting that all models be, through measurement and testing, provable true or false, the scientific method provides a powerful tool for collectively building a deeper understanding of our world, but other models are possible. Models that can, through scientific reason, be proven false are irrational, they are against reason, but there are also models that describe the universe beyond what we can see or measure. Such models are, by definition, beyond the realm of science, but

they are not anti-scientific; they are not built upon observation and reason, but they do not deny observation or oppose reason; they are not rational, but they are not irrational. They are superational(1); they are, by definition, permanent mysteries.

The Orthodox Christian Model

No one has ever seen God. [John 1:18] .

There are those who would attempt to use the tools of science to prove or disprove the truth of religious faith. According to the authors of the Christian Gospels and the fathers of the Christian Church in the first centuries of the common era, this was held as both impossible and incorrect. The early church fathers, who expressed no doubts about their belief in a monotheistic God, argued strenuously that, although the works of God can be known and although, through the world created by God, we can get a glimpse of what the Creator can and cannot be, we can never understand God himself. In the words of St. Basil the Great, "...we say that we know our God from His energies (operations), but do not undertake to approach near to His essence. His energies (operations) come down to us, but His essence remains beyond our reach." If the essence of God is beyond reach, it is beyond science, for science can only model what can be directly or indirectly measured. According to Orthodox thinking, God is beyond any human measure.

If God and faith are placed beyond the realm of reason, can we still create models and, if so, upon what basis can they be built?

This question was fiercely debated in the early centuries of the Christian Church, and from this effort emerged not just a definition of the Christian Faith, but a delineation of the borders of faith, a clear boundary between the philosophical study of this world and the theosophical study of God. Nearly two millennia ago, Orthodox Christianity created a model of faith that also ensures respect for scientific observation and conjecture. Many Orthodox Christians accept, based on faith, that this is a divinely inspired model. However, as divine inspiration is beyond measurement, science can only state that this model is consistent, useful, and cannot be disproved.

Recognizing that every man is fallible, it has since the early days of the Universal Church been accepted that only the Church meeting as a whole had the ability to speak for the Church. At the very first of these meetings, the Council of Nicea held in the year 325, it was necessary to address a controversy of what it implied when Christians proclaimed the man Jesus to be the Christ, the Son of God. The assembled bishops emphatically agreed that God's Son was one essence with his Father, and adopted a basic model, or Symbol, of the Christian Faith. This Symbol, which was affirmed and completed at the next Ecumenical Council, continues to be recited, unchanged, in all Orthodox churches today. One English translation(2) reads as follows:

I believe in one God, the Father, Almighty, Creator of heaven and earth and of all things visible and invisible.

And in one Lord Jesus Christ, the Son of God, the Only-begotten, begotten of the Father before all ages. Light from Light, True God from True God, begotten, not created, being of one Essence with the Father by

Whom all things were created.

Who for us men and for our salvation came from heaven and was incarnate by the Holy Spirit of the Virgin

Mary and became man.

And was crucified for us under Pontius Pilate, and suffered and was buried.

And on the third day, He rose, according to the Scriptures.

And ascended into heaven, and sitteth on the right hand of the Father.

And He shall come again with glory to judge the living and dead and His kingdom shall have no end.

And in the Holy Spirit, Lord Giver of life, Who proceedeth from the Father, Who with the Father and the Son together is worshipped and glorified, Who spoke through the Prophets.

In One, Holy, Catholic and Apostolic Church.

I acknowledge one baptism for the remission of sins.
I look for the resurrection of the dead.
And the life of the age to come.

The basis for this model is defined by the first two words "I believe". Why did the Orthodox Fathers choose these words?

The assembly could, for example, have chosen to begin with "There is", as "There is one God...", but they did more. Instead, whether translated in the singular or the plural, they began in the first person, and made the point clear by the next word: "believe". In Orthodox theology, the understanding of the Faith begins with the Faithful stopping to consider, realize, and verbalize not just what each Christian should believe, but the very fact that each individual must believe. An Orthodox Christian does not profess to "think" or "hope" or "agree", but is charged with a quest to "believe", to accept with certainty that which cannot be seen. Orthodox do not say "I know", but this is not because of doubt, but because Orthodoxy accepts an entirely different model. To know is to imply that the something can be seen and measured, while the Orthodox model maintains that Faith is, as stated by St. Paul, "the certitude of things unseen". [Heb 11:1]

Orthodox Faith begins with a reaching out of one person's heart, a desire to say "I believe", and then builds upon this a model of understanding whose certainty is felt.

The Conflict of the Non-conflicting

If we accept the pursuit of science as the creation of useful models for explaining measurable aspects of the physical universe, and then accept that the role of faith is to provide an understandable model of the realm beyond the measurable universe, it is clear that there is no obvious conflict between science and faith and that, in fact, such conflict is impossible. Scientific models demand that they be tested through observation; faith, by Orthodox definition, is a certitude of things that are not observable.

Why, then, is there so much written about the "conflict of science and faith"? Most often this is simply because we tend to apply the tools we are comfortable with and to understand language as we normally use it, forgetting that others who begin with a different modeling system may start with different assumptions or use the same language in a different way. Those who attempt to use scientific tools to disprove faith are clearly in error, for science can only prove or disprove what can be observed. Similarly, those who attempt to argue against a useful scientific model or to discourage the creation or discussion of such a model because they feel that the model threatens their understanding of scripture or tradition are adopting a position contrary to that of Orthodox Christianity.

Approaching Science from an Orthodox Perspective

"...we say that we know our God from His energies (operations), but do not undertake to approach near to His essence. His energies (operations) come down to us, but His essence remains beyond our reach." St. Basil the Great. If, as stated by St. Basil, "we know our God from His energies (operations)", those who would wish to know God should wish to seek knowledge of His energies (operations). St. Basil's words are, in effect, a call upon Orthodox Christians to not just tolerate scientific observation and conjecture about the physical universe, but to encourage and glorify those who do such work.

If it is true, as the Orthodox Church maintains, that the teachings of the Church sit securely within the bounds of God's revealed Truth, it would simply not be possible for any model of any observable aspect of the universe to intrude upon that model of Faith. Orthodoxy's clear demarcation of the realm of faith frees the Faithful to actively explore the universe with the assurance that no measured physical property or useful explanatory model can damage the Faith, and all those who would suggest otherwise or would use either Orthodox terminology or the authority of a Church office to criticize a purely scientific theory are not only acting inconsistently with the teachings of the fathers of the Church, but are propagating a teaching contrary to the Faith and ultimately harmful to the Faithful. Such a shallow and insecure model of faith is not consistent with Orthodox thought. Orthodoxy does not fear science, but embraces it.

Approaching Faith from a Scientific Perspective

Just as Orthodoxy teaches that the Faithful must not fear science, the rules of science compel the objective scientist to acknowledge that there is no reason to deny faith. In fact, an objective scientist must accept that there are aspects of the universe, at least the one we share today, which are immeasurable, unobservable, and unseeable, and must accept that science cannot offer a useful model of things which cannot in some way be seen, observed, or measured.

The logic of science teaches us that the limits to what we know are an inherent quality of the universe in which we live. Heisenberg's Uncertainty Principle, for example, states simply that we can know with certainty either the mass of an electron or its momentum, but never both at the same time. In other words, Heisenberg defines a clear boundary, beyond which observation is impossible. In the intervening years, numerous interpretations, some using language quite mystical, have been put forth as explanations of why the physical universe insists on maintaining such a mystery, but all we can see for certainty is that we know, as well as we know any scientific fact, that there are things we will never know.

A Bigger Box for Schrodinger

Recognizing that there exists the unseeable, it is possible to imagine a universe folded in upon itself such all that was unknown, all that was mysterious, was reduced to one, single unopened box the size of a steamer trunk. In such a universe, all that science would be able to state about that box is that it clearly exists, and that there is no way to see what is inside. Science can define with accuracy and predictability the edges of the box, but regarding what is inside the box the tools of observation and prediction do not apply.

That the box exists is not in question, but those who wish to discuss what is inside cannot use a scientific model, for no "as if" can be tested. All models of inside the box simply must begin with an "I believe", the modeling language of faith.

Clearly, though heaven's shadow in our universe is bigger than a breadbox, this should hold true for us, as well. As long as we remember that we are always communicating using models, as long as we understand that science speaks with "as if" and faith with "I believe", and as long as we are clear which model we are using, there can be no conflict between science and faith in public discourse.

That the Orthodox Christian model for dialogue between science and faith leads quite naturally to exactly this result, suggests that, in our universe, the model taught by Orthodoxy is an appropriate, useful model to apply.

(1) As used by Fr. Alexander Schmemmann.

<http://www.orthodoxcanada.org/sciandorth/koroluk.htm>

Continuing the series on *Darwin and Christianity* by Fr Thomas Hopko:

http://ancientfaith.com/podcasts/hopko/darwin_and_christianity_-_part_10_the_genesis_account_part_4