

Science, Religion, and Science Fiction

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5 May 1998; updated June 2005, April, August 2006, November 2007

A talk presented at Carolina Meadows, Chapel Hill, NC, to a general audience

In this talk I present a viewpoint that I think is shared by many scientists.

When I was an officer in the Navy there was a rule that one was not allowed to talk about women, religion, or politics in the Wardroom, the dining room. I am no longer in the Navy and it isn't dinner time, so I feel free to present some views about religion, but I will skip sex and politics: items that seem to go together these days!

First, a few words about science. Here is a pertinent definition of its main roles. (Jane Lubchenco, *Science* 279(1998)491)

“Science is the pursuit of knowledge about how the world works, a pursuit with an established process for inquiry, logic, and validation. Scientists engage in science because we are curious about why things are the way they are, we relish the fun and challenges of problem-solving, and we wish to contribute something useful to current and future generations. Society supports science because doing so in the past has brought benefits and doing so now is expected to provide more. Traditional roles of science have been to discover, communicate, apply knowledge, and to train the next generation of scientists.

Society currently expects two outcomes from its investment in science. The first is the production of the best possible science regardless of area; and the second is the production of something useful.”

Neils Bohr, one of the founders of quantum mechanics, said, “Science is not a means of obtaining absolute truth. The real test of a scientific theory is not whether it is “true,” but whether it works.” The brilliant physicist Richard Feynman said “Experiment is the sole judge of scientific truth.”

The essence of science is replication in experimental investigations. The philosopher, Alfred North Whitehead, said, “The mentality of modern science is

forged through the union of passionate interest in the detailed facts with equal devotion to abstract generalization.”

The distinguished biologist, E. O. Wilson, has said, “The ideal scientist thinks like a poet and works like a bookkeeper.”

Science and religion are similar in that they are different ways of addressing some of the same crucial questions of life, for example,

How did everything begin?

How will it end?

What is life and what is its future?

What is consciousness?

Do we have free will?

But science and religion approach these problems differently. As Francis Bacon said at the beginning of the enlightenment, “Experimental investigation is essential to scientific progress.”

There is only one science in the world, though it has many parts such as physics, chemistry, and biology. But science is a consistent, coordinated whole, a unity, any of whose statements may be checked by experiment by anyone, anywhere. There is only a single physics, not a Russian or Italian one. Science is forward-looking, developmental, and open to change by anyone with a good idea.

On the other hand, religion is conservative, a protector of the *status quo*, as it was when it required the burning at the stake of the Italian philosopher Giordano Bruno in 1600 because he rejected the church-supported, earth-centered Aristotelian astronomy in favor of the Copernican view that the earth orbits the sun. Further, because religious tenets are based on faith, they are not open to experimental verification or refutation, thus resulting in the existence of very many disparate religions with different views and beliefs. Unlike science, faith and feelings provide no boundary that might limit any delusion, and they can thus provide the illusion of moral sanction for any depravity, but also they have led to some of the highest achievements of the human spirit, such as Bach’s masses and Beethoven’s last quartets.

The disunity of religion, arising from different beliefs, has been and remains

one of the pre-eminent causes of discord, war, and death in the world. All religions say, “God’s on our side.” But who is on the side of the earth itself, of its people, and of its precious cargo of life? We all should be!

In a recent poll, it was found that about 40% of scientists believed in the existence of some kind of god. Some writers have suggested that evolution may have resulted in an inborn need for humanity to believe in the existence of intangible beings such as gods, ghosts, or space aliens. A recent book by Daniel Dennett about this possibility is subtitled “Religion as a Natural Phenomenon.” Although a recent Gallop poll found that 71% of the general USA populace believed there is life after death, only 26% held such beliefs in Denmark, and only 16% of leading scientists so believed.

Lucretius said, “Religion is the byproduct of fear.” And it is certainly true that most people would like to have a big daddy in the sky watching over them. Then they wouldn’t have to assume so much responsibility for their decisions, errors, and lives.

Marx said, “Religion is the opiate of the people,” and Wilson Mizener said, “I respect faith, but doubt is what gets you an education.”

The distinguished British philosopher, A. J. Ayer, in a book on language, truth, and logic, says,

“I require of an empirical hypothesis not that it should be conclusively verifiable, but that some possible sense-experience should be relevant to the determination of its truth or falsehood. If a proposition fails to satisfy this principle, and is not a tautology, I hold that it is metaphysical and is thus neither true nor false, but literally senseless. Thus, it cannot be significantly asserted that men have immortal souls or that there is a transcendent God.”

By this approach and test, one generally applied by most scientists, it follows that most tenets of the Christian religion, such as

Original sin,
The existence of a personal god,
Virgin birth,
Physical resurrection,

Divinity of Jesus,
Jesus's death on the cross as a substitute for our sins,
Jesus's physical resurrection and impending return,

and

Transubstantiation,

are meaningless.

Let me conclude this somber discussion of religion on a lighter note. First, here are some reasons why God never got a PhD:

She had only one major publication
It was in Hebrew
It had no references
It wasn't published in a refereed journal
Some even doubt he wrote it by himself
It may be true that she created the world, but what has she done since then?
The scientific community has had a hard time replicating his results
He never applied to the ethics board for permission to use human subjects
When one experiment went awry, she tried to cover it up by drowning her subjects
She rarely came to class, just told students to read the book
Some say he had his son teach the class
She expelled her first two students for learning too much
Although there were only 10 requirements, most of the students failed his tests
Her office hours were infrequent and usually held on a mountain top.

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Finally, most of you will probably know the limerick:

There was a man who said, "God
Must think it exceedingly odd
If he finds that this tree
Continues to be
When there's no one about in the quad."

The reply:

Dear Sir: Your astonishment's odd
I am always about in the quad.
And that's why the tree
Will continue to be,
Since observed by
Yours faithfully, God.

Now back to science:

There have been five principal world-shaking and world-changing developments in science and engineering in the last 150 years:

The theory of evolution by natural selection of Darwin and Wallace.

Although called a theory, it is factually justified; evolution is crucial and is still going on; and "Intelligent design" is a ploy to try to discredit it. A recent study (Science, 11 August 2006, p.765) indicates that 40% of US adults accept the theory of evolution and 39% overtly reject it. In contrast, studies show that in Europe and Japan about 80% of those surveyed accepted the theory. Most of the difference is ascribed to widespread fundamentalism and politicization of science in the US.

The discovery of DNA and its crucial function in heredity and development.

The burgeoning of means of communication and dissemination of knowledge through such developments as cell phones and especially the internet.

Einstein's theories of relativity - the general theory being a theory of gravity.

Quantum mechanics - developed principally by Schroedinger and Heisenberg.

This is a theory of particles and waves and has been shown to agree with experiment to the current limit of measurement, at least to one part in better than 100 million. There can be no doubt that any future theory must agree with quantum mechanics within its domain.

Unfortunately, there is as yet no satisfactory synthesis of quantum mechanics and gravity: quantum gravity. When and if we are able to develop such a theory, it will apply to all physical processes in the universe. Most scientists would say that this includes everything and would explain why the universe behaves the way it does.

There is currently at least one approach to quantum gravity that looks somewhat promising: superstring theory. It begins with 10 dimensions of space and one of time. To give you a flavor of this subject, let me quote a sentence from a recent review paper written for scientists who are not experts in this field,

“It is the first Kaluza-Klein excitation of the eleven-dimensional supergravity multiplet on the circular eleventh dimension.”

Wow! Good thing it wasn't written for experts! There is still much work remaining to obtain a full theory, but it is thought that one would probably allow the resolution of the many paradoxes present in ordinary quantum mechanics. Insufficient available time precludes description here of the paradox of Schroedinger's cat, discussion of the anthropic principle, and of the many-worlds hypothesis.

It is well accepted in science that ideas and theories can only be falsified, never proved correct. This is one reason why most of the basic laws of physics are posed as impossibilities. For example, it is impossible for any entity with mass to move at the speed of light in vacuum, and it is not possible to measure accurately both the position and velocity simultaneously of any physical entity, such as an electron. Only a single replicable experimental measurement that led to velocities greater than that of light in vacuum would be sufficient to falsify a tremendous amount of modern physics. No such result has ever been found.

Deconstructionists and postmodernists claim that science does not yield an objective, accurate reflection of the real world but is only culturally mediated. These claims are false and are an indication of deep scientific illiteracy, a bane of our current cultural milieu. For example, most popular modern American history texts ignore the impact of technology on society, although nothing has had a more profound impact in the 20th century. One needs only to think of medical advances, the development of modern transportation and communications, computers, lasers, etc., to be convinced that the most profound changes in the lives of citizens from

1898 to 2007 have come from technological change brought about by scientists and engineers.

Science and its brother, engineering, have become the economic engine of the world and continue to help improve the quality of life. Since the future well-being of the world, and particularly that of the USA, depend on continuing advances in basic and applied science, it is frightening to see the extent of scientific illiteracy prevalent today. For example, a recent study found that

Less than one half of American adults understand that the earth orbits the sun yearly;

Only 21% can define DNA;

and only 9% know what a molecule is.

The support of science in the future requires better education and debunking of the pseudo sciences such as: belief in the existence of vampires, flying saucers, space aliens, mediums, astrology, and creationism. *Although everyone is entitled to their own opinion, no one is entitled to their own facts.* In this regard, I strongly recommend the recent book, “God: The Failed Hypothesis – How Science Shows That God Does Not Exist,” by V. J. Stenger, Prometheus Books, New York, 2007.

It is important, I think, to distinguish between belief in a theistic (personal) God and a deistic or even atheistic acceptance of the good done by religious people and acknowledgment of the grandeur of the universe, which may not even have had a creator in our sense and understanding of that word. In this regard, I also highly recommend the book, “**Jesus** for the Non-Religious,” by John S. Spong (a retired Episcopal bishop), Harper, San Francisco, 2007. It goes far toward separating Christianity from religion, and Jesus from the myths about him. Spong emphasizes that the call of Jesus is one to be fully human, as Jesus himself was; a humanistic viewpoint that many can admire, accept, and perhaps even try to emulate.

Physics and astrophysics have shown that our universe started somewhat less than 15 billion years ago with the “big bang,” an incredibly rapid expansion of energy and mass from an infinitesimal region. It is meaningless to ask what happened before this or to ask what started it off. Some things are intrinsically transcendental. Astrophysical measurements and theory indicate that the universe will either keep expanding or will eventually start contracting to a point, the “big

crunch.” These possibilities are further discussed later.

I included science fiction in the title of the present talk because I have been reading it for many years, and, more important, because much of advanced physics and engineering seems to be converging toward science fiction ideas. So let me move toward these ideas.

First, consider consciousness, one of the most mysterious things in the universe. Although I have no way of establishing for certain that the rest of humanity is not a group of flesh robots without self awareness, my own experience of being self-aware strongly suggests that you all are too.

There was a German philosopher named Vaihinger, who introduced a philosophy of “as if.” If it appears that something seems *as if* it were true and there is no way to absolutely establish its truth or falsehood (the situation for intangible things), then it is reasonable to act *as if* it is true. This criterion eliminates for me the concept of the soul, but let us apply it to free will. It appears that we have it, but we can’t prove it. So we might as well act as though we have it. Jonathan Edwards (1703-1758), the foremost Puritan theologian, was an early exponent of this ameliorated materialistic viewpoint.

Actually, I believe that we always do what we want to do and, as well, what we *must* do because of the influences of heredity, environment, and chance. Thus if you must make the choice between saving your spouse or your baby from drowning and there is no time to save them both, you make a choice and do it, proving that that particular choice is what you most wanted to do, no matter what you may say and feel retrospectively.

I believe that animals are self aware to some degree, especially apes. But it seems to me that an important distinction between them and us is that we are aware that we are self aware and they seem not to be.

The human brain is the most complicated thing we know about in the universe, and we are only just beginning to understand a bit about it. It seems reasonable to assume that self-awareness is a function of brain action. Thus, in some sense, we can identify consciousness (including our subconscious) as a pattern or program running in the brain, a process perhaps somewhat similar to a computer executing a program.

Many computer scientists believe in so-called strong artificial intelligence, defined as follows:

All thinking is computation; in particular, feelings of conscious awareness are evoked by the carrying out of appropriate computations.

On the other hand, the distinguished physicist Roger Penrose believes:

Appropriate physical action of the brain evokes awareness, but the physical action cannot be properly simulated computationally.

Many scientists, including me and probably Steven Hawking, incline to the first view. Note that if this strong artificial intelligence view proves correct, it will be possible, perhaps in as soon as 100 years, to create computer programs which will give every indication of being self aware and aware of it, and may be as intelligent and creative as we are. Then, by further developing themselves, they will soon surpass us since they will operate at speeds far greater than we can. But we are driven by emotion in virtually all our actions, and it seems that some analog of emotion will be necessary as a part of artificial (non-carbon based) intelligences.

In Star Trek, the transporter analyzes a person completely, dissolves the body, and recreates it without a receiver somewhere else as exactly the same flesh and blood pattern. This is absolutely impossible, but what if we could analyze everything in your brain and thus determine your current consciousness pattern and then run this on a sufficiently advanced supercomputer? This too is impossible but may not remain so forever. If it were possible, you could “live” in the computer and be unable to tell whether you were true flesh and blood or a computer simulation. Maybe we all are already programs in such a supercomputer, but applying the “as if” criterion it is reasonable to assume that we are not such programs unless one defines the universe as a supercomputer.

This background brings me finally to an extraordinary recent book by Professor Frank Tipler, a well-regarded theoretical astrophysicist and relativist. It is grounded in hard physics and is not science fiction, but many will think it is fiction because its conclusions are extreme. Some of them depend on the belief, current at the time the book was written, that the universe will eventually stop expanding and begin to condense toward “the big crunch” where it eventually ends up as a black hole. Unfortunately for Tipler and his end-of-universe hypotheses,

there is now strong evidence that the expansion of the universe will never reverse.

The book's title is, "The Physics of Immortality," and in it Tipler shows that, given some probably not impossible assumptions, life will eventually move to intelligent self-aware machines and expand throughout the universe. Near the final stages of the big crunch there will be so much computing capacity available that the evolved joint intelligence of the universe, now called the Omega Point and identified with God, will then be able to, and will want to, resurrect all self-aware life that has ever existed in the universe and simulate it by computer programs. Thus, long after we die, we may all be reincarnated as simulations at the end of time. But for technical reasons, the time available in the computer for us to continue to have experiences (the real definition of living) will be effectively infinite - a pretty close definition of heaven.

The universe may be more strange and complicated than we know or even can possibly know. Nevertheless, the scientist believes that in principle it can be understood entirely in terms of physical (including biological) processes. I want to conclude with two examples of strangeness, neither of which can be explained in terms of our current philosophy and physical understanding.

The first is the result of a recent double blind test of the efficacy of prayer on 100 or more sick people in a hospital. One group was prayed for over a period of time by a large outside group and the other was not. It was found that the prayed-for group showed appreciably more statistically significant improvement than did the other group. Some will want to believe that God answered these prayers. I believe, however, that if the effect exists (the methodology used has been strongly criticized), it indicates the presence of an unknown physical process which should be explored, replicated, and quantified. Further, from an empirical viewpoint, if prayers were indeed efficacious in producing such real-world effects, surely they would have eliminated monsters such as Hitler and Stalin early in their reigns.

Unfortunately for the efficacy of the prayer-to-a-personal-god hypothesis, the results of a large study of prayer, funded by the Templeton Foundation and released in 2006, were negative. For the 600 heart-bypass-surgery patients for whom other people prayed, there were as many complications present as for the 600 for whom there was no such prayer. Remarkably, for the remaining group of 600 who were told they were being prayed for, there were about 13% greater complications – apparently a psychological effect rather than an instance of God's punishment for unwarranted presumption! Of course, if no agreeable personal god

exists, there would be no basis for the belief in the usefulness of prayer.

One should not try to constrain God, if he exists, but instead try to explain the wonders of our universe, a main task of science.

The other surprising event happened to me. A few years ago at lunch I said to my wife, "I am Gaspard de la Nuit." Expecting silliness from me now and then, she said, "Yes, dear." But Gaspard de la Nuit is the title of a seldom-played piece of music by Ravel, one that I hadn't heard or thought of in 20 years or more. That night, I heard it on the radio. Was this just an exceedingly improbable coincidence or did my moment of existence briefly extend from lunch time to that night and thus brought back this morsel to current time? If so, it is too bad it doesn't seem to work when one needs it, for example, for predicting stock market changes!

Thank you for your attention. For reasons made clear in the talk, I refrain from the trite ending, "God Bless!"