RELIGION/TECHNOLOGY, NOT THEOLOGY/SCIENCE, AS THE DEFINING DICHOTOMY

by Rustum Roy

Abstract. Science and religion are incommensurable: one cannot use centimeters to measure volume. Science's proper cognate is theology. Science and theology are human activities that are basically conceptual (partly fallible) frameworks for explaining experience. Religion and technology, by contrast, involve and control or limit human *practice* and *experience*: they involve "sensate" reality—people and things. The study of the interaction of these four terms (or any two) must use the terms more precisely.

Science as practiced today has become *scientism*, another theology. Technology is, without any doubt, the world's most powerful and fastest growing religion.

Minor squabbles among theologies, including science, must continue, but it is the tensions between technology and the established religions that will define this century. Battles on three fronts are already clear: the environment, globalization, and economic gaps. But whole-person healing, the replacement for high-tech reductionist modern medicine, is the most significant, because it will undermine science, which has hitched its wagon to this falling star.

The end of fundamental science is upon us, because it has been so successful. Science will be increasingly applications-driven, and it will be judged by results. Here, it has met its nemesis in whole-person healing that incorporates integrative medicine. Scientists must now reconsider their role in society. It will not be easy to accept a humbler position. Moreover, the vague allusions to spirituality by scientists need a more authentic commitment to praxis in lifestyle.

Rustum Roy is Evan Pugh Professor of the Solid State Emeritus, Professor of Geochemistry, and Professor of Science, Technology, and Society at Pennsylvania State University. He is also a Visiting Professor of Medicine at the University of Arizona and a Distiguished Visiting Professor of Materials at Arizona State University. His mailing address is 102 Materials Research Laboratory, University Park, PA 16802; e-mail rroy@psu.edu. A version of this paper was delivered at the forty-eighth annual conference of the Institute on Religion in an Age of Science, "Human Meaning in a Technological Culture," held on Star Island, New Hampshire, 28 July–4 August 2001.

[*Zygon*, vol. 37, no. 3 (September 2002).]
 ISSN 0591-2385

Keywords: medicine; reality test; science-theology relation; spiritual fuzziness; technology-religion relation.

There is so much confusion in the science-religion conversation or controversy that it is difficult to know where to begin. But as responsible citizens and academics we must, as Dag Hammarskjöld admonished us long ago, have great respect for the word.[1] I start, therefore, by trying to clarify the terminology around the four key words: religion, technology, theology, science.

I write from the biases developed in my personal history. I was raised in India by upper-middle-class parents who were active Christians by choice, albeit thirty-third-generation Brahmins genetically and socially. Schooled in the best British private schools, I was equally devoted to the classics and to religion and science. That balance of interest and active involvement has persisted through my life in the United States since 1945. I have been actively participating in the frontiers of modern science as a materials scientist for fifty-three years. For the same period, I have been actively involved in the development and modification of the religious institutions of our time. Hence, I have spent nearly equal times in each element of the 2 x 2 matrix that is depicted below.

Science	Theology
Technology	Religion

I start by clarifying the science-technology definitions, building on my science policy book with Deborah Shapley, *Lost at the Frontier* (Shapley and Roy 1985), which makes the case that it is technology that leads to science, not the other way around.

Between religion (technology) and theology (science), the same relationships exist. Religion is based on the empirically adopted practices of groups of humans, who adopt specific myth structures that roughly fit the practices but may well affect the practices as time goes by and the myth is elaborated on by powerful leaders. Centuries and millennia test the religious practices, but not the theological formulation, for survival value.

These relationships are sketched in Figure 1, which adds a dimension to the degree of abstraction in the science-religion conversation. My own emphasis is that "Faith is the substance of things" (Teilhard 1976) and, as Derek Price, Yale University's dean of science policy, has argued (1976), that thermodynamics (basic science) comes from the *experience* of steam engines (technology).

In my book *Experimenting with Truth* (1981) I introduced the term *reality theology*—the embodiment of one's belief structure into concrete

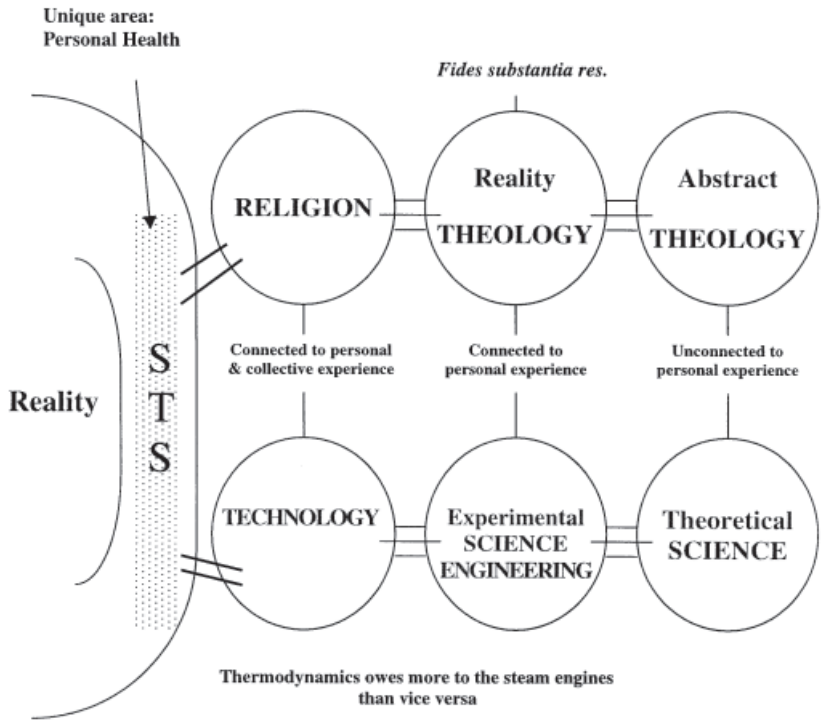

Fig. 1. Between religion (technology) and theology (science), the same relationships exist.

behaviors. In my own scientific research, my approach has equally been to emphasize experimental confirmation of any theoretical concepts. The two human efforts of religion and technology must converge at their contact with reality. And as the shaded area in Figure 1 attempts to show, the academic world has, in the last thirty years, slowly come to accept this area of overlap as a discipline (area of academic study) under the accurately descriptive term, *Science, Technology, and Society (STS)*. If ever there is an appropriate academic home for the Religion/Technology and Theology/Science question, it will be within the STS programs already established on many of the major United States campuses and moving into the secondary schools.

In the last decade a new term has entered the discussion: *spirituality.* It is worth a digression because it can cause confusion. In Figure 2, I have attempted to diagram the relationships of science, technology, theology, and religion to spirituality. Whereas most religions include a spiritual and mystical dimension, modern spirituality disavows any reduction to practice. Two recent books are helpful. *Spirit Matters* by Michael Lerner (2000)

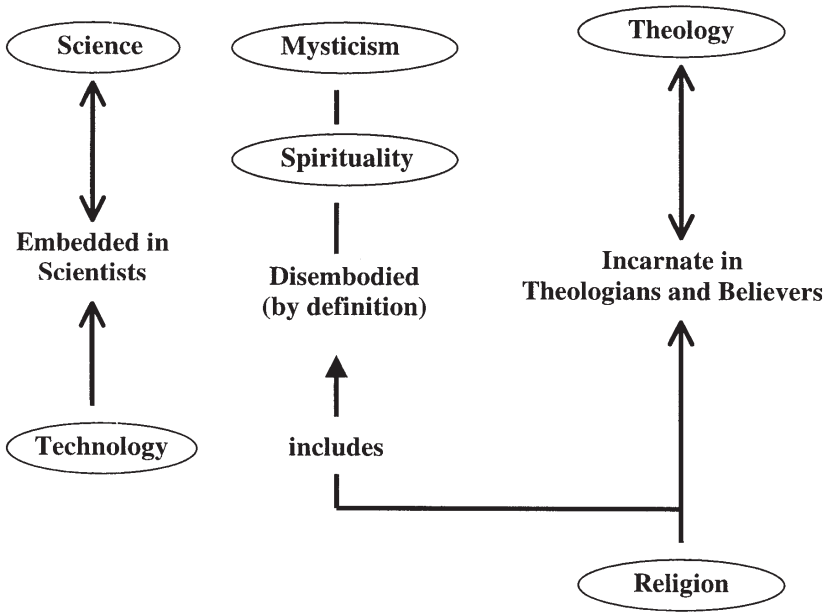

Fig. 2. The relationships of science, technology, theology, and religion to spirituality.

affirms the transcendental dimension of life and its importance. More significant is Huston Smith's *Why Religion Matters* (2000), in which he strongly criticizes the casual use of spirituality in our culture and calls attention to scientists' ignorance of other fields, especially religion, even though they often comment on it.

The Status of Religion/Technology and Theology/Science

Religion and technology are the two major forces shaping the culture today. No more dramatic juxtaposition of the powers of both is needed than the impact of the dot.com meltdown and the Enron "explosion" on the one hand, and the September 11, 2001, event on the other. But these serve well as examples of skirmishes in the emerging "Clash of the Titans" (Roy 1995, 136) which I identified at the Parliament of the World's Religions in Chicago in 1993. From that paper, I show but one table (Table 1), showing how international technology functions to replace what traditional religions offer.

These two giant force fields of culture, religion and technology, have interpenetrated each other, in the interest of human survival (see Roy 1981). With the development of worldwide television and the Internet, it is clear

that technology is the world's most powerful, most unified, and most rapidly growing religion in every sense of the word. Its "religious practices," linked largely to consumerism and rejection of altruism, are spread by the irresistible forces of the media. It is therefore seen as, and often in fact is, directly competing for territory and power with every one of the world's religions. September 11, in that picture, is a kind of opening salvo by one religion on one front. The nature of the resistance or confrontation will hardly resemble September 11, but it is certain to be a permanent part of our future.

Table 1 (from Roy 1995, 136)

Culture-Tradition-Religion	**International Technology**
Provided for:	Now offers:
1. Meaning of life	1. To explain origin of universe, life, etc., via science
2. Structure of society—laws, ethics, rules—governing everything (e.g., dietary laws, keeping the Sabbath, coveting as sin)	2. To dominate the reality of every aspect. Rules, ethics, laws with exactly the opposite effect, no dietary laws, no Sabbath, coveting as a virtue for consumerism.
3. Help in crisis • health • death, etc.	3. High-tech crisis management • health care • death, etc.

Science and Religion: A Different Relationship

Having clarified the terms and shown the incommensurability of these two particular human ventures, we now move to make the distinctions.

Consider the Mount Rushmore National Memorial. How can it be understood by science and religion? Culture and religion affirm that it is a national monument, with giant images of former presidents stirring memories and passions in U.S. citizens, perhaps to attempt great achievements. It touches emotions and leads to actions.

What can science contribute to our understanding of this connection? Nothing, or very little. Why? Because scientists can do little more than examine the calcite crystals that make up the glasses on Teddy Roosevelt's nose. Science deals with tiny points, not the assembling of the points into a pattern. Making a picture is not its forte, indeed not its business. Religion, conversely, deals only with the big picture and often goes astray in detailing the points (e.g., the dietary laws of believers who have moved to a radically different climate and environment).

There is another key distinction. It can be seen in Stephen Kline's concept of science and religion in his book *Conceptual Foundations for Multidisciplinary Thinking* (1995), from which Figure 3 has been adapted. Religion deals mainly with "ground zero for humans" on the scale of a person's or a group's needs. Contemporary science, which once was about explaining a human's experience of nature, has retreated to the outer fringes of nano-, pico-, femto-, giga-, and tera- orders of magnitude away from the interest or comprehension of 95 percent of humans.[2]

Much of the so-called science-religion debate brilliantly shows its own irrelevance, to all but partisans on either side. The majority of scientists have converted to scientism, often arguing, against "There is no god but Allah [or XYZ]," that science is the *only* road to truth, wisdom, and learning.

The old chestnut of the religious story of creation versus the scientific theory of evolution is used again and again on both sides, without point-

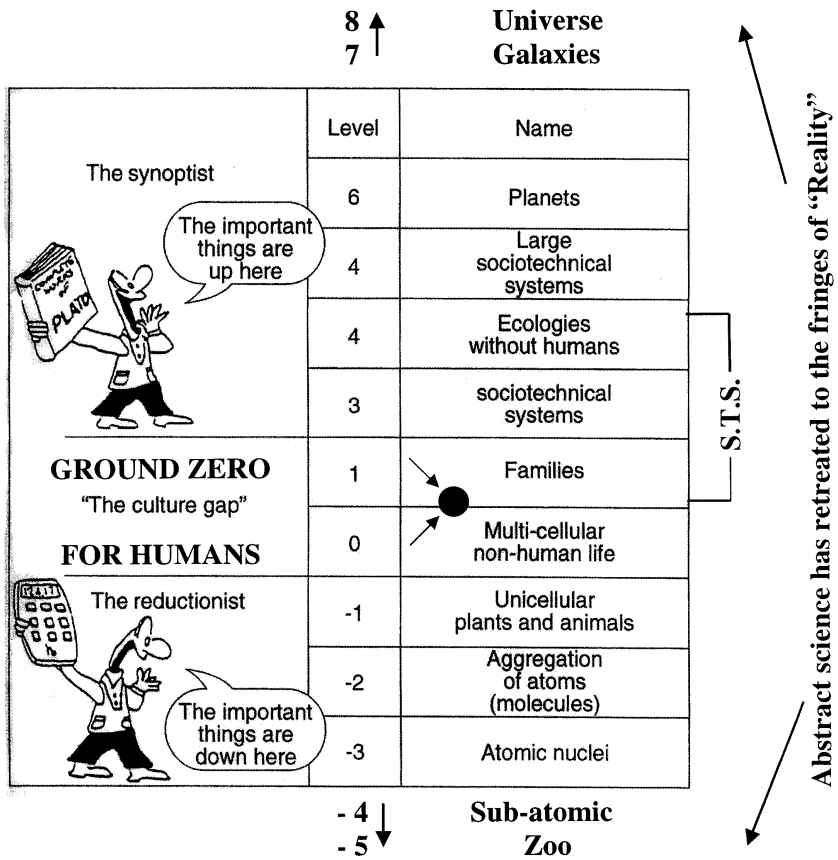

Fig. 3. The relationships of science, technology, theology, and religion to spirituality. Adapted from Kline 1995.

ing out that current cosmology is but a small part of science, irrelevant to 99 percent of the citizens, and that the creation story in Genesis 1 takes up one column on one page in a thousand-page book. Only the fundamentalists *on both sides* need care about those issues, since they are unrelated to most human, personal, or societal choices.

The End of Science

What is most significant about the status of science today is the increasingly widespread recognition among many observers that fundamental science is wound up, complete, "ended" (Roy 1981). One can define *fundamental science* as that which affects ever-widening circles of neighboring sciences. This definition was first proposed by Alvin Weinberg in his classic "Criteria for Scientific Choice" (Weinberg 1963).

This is the really new feature on the horizon—that "basic science," the kind that is determined by the curiosity of individual investigators alone, not aimed at any goal or product but at understanding, is coming to an end. This end-of-science motif has been expanded on in four books: John Horgan's *The End of Science* (1996), Daniel Sarewitz's *Frontiers of Illusion* (1996), Jean Gimpel's *The End of the Future* (1995), and Rupert Sheldrake's *Seven Experiments That Could Change the World* (1995). The simple empirical fact is that since World War II, in spite of an *annual* worldwide research and development effort of several orders of magnitude greater than the *total* scientific effort before World War II, nothing fundamentally new—remotely approaching the significance of the discovery of quantum mechanics—has emerged. Science has fissioned into ever-narrower niches, with each discovery confined to the narrower field. The experimental proof of this judgment is the fact that the corporate world, since 1992, has eliminated its basic or nontargeted research for the very sound reason that nothing useful can be expected to emerge via that route. They have turned to applications-pulled science, which can include, to be sure, long-term basic science.

The future of science is in such real science—the sciences of agriculture, materials, health, engineering, and earth science—where one can touch, see, and feel the results. It will be applications-driven science that includes new very basic science but is always oriented toward a goal. It is essential that scientists, administrators, and journalists present scientific developments honestly.

Rescuing Science from Reductionism: Whole-Person Healing

Reductionism has served science well. However, its illicit claims and exaggerations, transferred to a whole-person world, have eroded science's credibility. The reason for this erosion is the meteoric rise of whole-person (or

integrative or complementary) medicine. Scientific or high-tech medicine —as practiced in every primitive culture—was the proving ground to the public of the validity of the religion of science. For fifty postwar years, miracle drugs and new tools for diagnosis and surgery were the authentication of the scientific worldview. Antibiotics made relativity theory believable; X-rays and MRIs made details of the Big Bang and redshifts credible, even if esoteric and changeable. The experience of healing by medicine conferred credibility on all high science.

But suddenly, since 1995, the heroes of healing have changed. Deepak Chopra, Andrew Weil, Dean Ornish, Larry Dossey, Herbert Benson, and others are the new gurus or champions of whole-person medicine. They have been given more sustained attention in the media as healers than any other scientist (with the exception of Albert Einstein). Their message is quintessentially wholist, integrationist, and fundamentally antireductionist. The whole person is body-mind-and-spirit and may be accessed by any combination of those channels.

As establishment science reaches farther into the fringes of the reductionist forest, it is ceding more ground in the popular mind, including (proportionately) scientists, to integration and wholeness, as experienced by tens of millions of Americans. Whole-person healing is the testing ground for this new perspective.

The speed with which complementary and alternative medicine has penetrated the healing market is breathtaking. When one takes into account legal, scientific, and political "cheating" and pressure by the Ameri-

Table 2. The Meteoric Rise of Whole Person Medicine
(from Eisenberg 1998)

	1990	**1997**
Use of any one of sixteen alternative therapies	33.8%	42.1%
Visiting any A.T. provider	36.3	46.3
Disclosed to physician	39.8	38.5
Percentage paying out-of-pocket	64	58.3
Total visits to A.T.	427 ($x10^6$)	629 ($x10^6$)*
	47% increase	
Expenditures for A.T services	$14.6 (B)	$21.2 (B)
TOTAL expenditure for A.T.		27.0[@]
Out of pocket (for services)		12.2[#]

* this number exceeds total visits to U.S. primary care physicians
[@]comparable to total o.o.p. expenditures for all U.S. physician services
[#]Exceeds total out-of-pocket for all hospitalizations

can Medical Association, in combination with the astronomical advertising budgets of the pharmaceutical industries, detailed in the books by Dan Haley (2000) and Kenny Ausubel (2000), it is doubly surprising that integrative medicine could have "stormed the Bastille" so suddenly, that in less than two decades, as Table 2 shows, half of the U.S. population pays out of its own pocket for "alternatives." One wonders what the ratio would be on a level playing field, with either both synthetic pharmaceuticals and alternatives or neither covered by insurance.

The attempt by Western medicine, in an era of globalization, to maintain a monopoly for its reductionist, body-only approach is foolish. Imagine basing one's theory on the equation that P=B (a person is a body) instead of P=B+M+S (a person is body, mind, and spirit). Imagine basing a health system on fighting off inevitable death at literally all costs.

Whole-person healing that incorporates integrative medicine is winning the day. It remains to be seen what kind of system emerges, but it will have room for a host of alternatives.

A Final Question: What Are the Lifestyle Commitments of Spiritual Scientists?

Science is vague and abstract; to the public it is reified in persons. The scientists' commitment to *science* is easily seen. The more appropriate question is: In what concrete form of commitment is the spirituality of the scientist manifest? What, in Gandhi's terms, is their sacrifice?—what service, social cause, work for political or social goals, or work for the poor? Einstein seemed committed to such a reified spiritual quest: "Concern for man himself and his fate must always form the chief interest of all technical endeavors—concern for the great unsolved problems of the organization of labor and the distribution of goods—in order that the creation of our minds shall be a blessing and not a curse to mankind. Never forget this amid your diagrams and equations" (Einstein 1960).

I personally have found great spiritual growth via this route of working on "the role of labor, and the distribution of goods" in our contemporary society, where these issues are significant.

I close with what is perhaps a more thoughtful analysis by a scientist, for consideration by all scientists. It appears at the end of C. F. von Weizsäcker's book *The History of Nature* (1976):

> The scientific and technical world of modern man is the result of his daring enterprise, knowledge without love. Such knowledge is in itself neither good nor bad. Its worth depends on what power it serves. Its ideal has been to remain free of any power. Thus, it has freed man step by step of all his bonds of instinct and tradition, but has not led him into the new bond of love.

Von Weizsäcker, the physicist-theologian, then shows how the disconnection between knowledge and love has led to despair and nihilism and, I

would add, to ignoring the social and political context of science and technology. In effect, science-technology has become, thereby, the unconscious agent of the forces of reaction—"the devil," following von Weizsäcker (1976) in his most perceptive Garden of Eden analogy:

> But when knowledge without love becomes the hireling of the resistance against love, then it assumes the role which in . . . mythical imagery is the role of the devil. The serpent in paradise urges on man knowledge without love. . . . is the power in history that leads loveless knowledge into the battle of destruction against love. But it is at the same time also the power that destroys itself in its triumph. The battle is still raging. We are in the midst of it, at a post not of our choosing where we must prove ourselves.

NOTES

1. *Science* as we understand it today is the fruit of the modern technological industrial world that describes and formulates the abstract part of the reality common to all technologies, which has been established and confirmed by controlled experiments and the test of time. *Technology* is the human use of material, human, and societal-organizational tools that integrate science with many other inputs to attain a given end.
2. The ignorance of Americans about science must be seen to be believed. The following two videos show in living color that 95 percent of Harvard and MIT graduates believe, among other errors, that summer is caused by the earth's moving closer to the sun: "Minds of Our Own" (Burlington, Vt.: Annenberg/CPB, Math and Science, 1997) and "A Private Universe" (Santa Monica, Calif.: Pyramid Film and Video, 1997).

REFERENCES

Ausubel, Kenny. 2000. *When Healing Becomes a Crime*. Rochester, Vt.: Inner Traditions International.
Einstein, Albert. 1960. *Einstein on Peace*. New York: Simon and Schuster.
Eisenberg, David M., et al. 1998. "Trends in Alternative Medicine Use in the United States, 1990–1997: Results of a Follow-up National Survey." *Journal of the American Medical Association* 280 (18): 1569–75.
Gimpel, Jean. 1995. *The End of the Future*. Westport, Ct.: Prager.
Haley, Dan. 2000. *Politics in Healing*. Washington, D.C.: Potomac Valley Press.
Horgan, John. 1996. *The End of Science*. Menlo Park, Calif.: Addison Wesley.
Kline, Stephen. 1995. *Conceptual Foundations for Multidisciplinary Thinking.* Stanford, Calif.: Stanford Univ. Press.
Lerner, Michael. 2000. *Spirit Matters*. Charlottesville, Va.: Hampton Roads Publishing.
Price, Derek John de Solla. 1976. *Science Since Babylon.* New Haven, Ct.: Yale Univ. Press.
Roy, Rustum. 1981. *Experimenting with Truth*. New York: Pergamon Press.
———. 1995. "The Coming Clash of the Titans." In *Cosmic Beginnings and Human Ends,* ed. Clifford N. Matthews and Roy Abraham Varghese, 129–54. Chicago: Open Court.
Sarewitz, Daniel. 1996. *Frontiers of Illusion*. Philadelphia: Temple Univ. Press.
Shapley, Deborah, and Rustum Roy. 1985. *Lost at the Frontier*. Philadelphia: ISI Press.
Sheldrake, Rupert. 1995. *Seven Experiments That Could Change the World*. New York: Riverhead.
Smith, Huston. 2000. *Why Religion Matters*. San Francisco: Harper.
Teilhard de Chardin, Pierre. 1976. *Phenomenon of Man.* New York: Harper Perennial.
Von Weizsäcker, Carl F. 1976. *The History of Nature*. Chicago: Univ. of Chicago Press.
Weinberg, Alvin. 1963. "Criteria for Scientific Choice." *Minerva*, 159–71.