

Humanity in Time and Space

Victor J. Stenger

Essay published in *Free Inquiry* Vol. 21 No. 2 Spring 2001.

Since Galileo first turned his telescope on the heavens, scientific instruments have steadily expanded our view of the universe so that we can now peer far beyond the puny range of unaided human sensory apparatus. What we see when we look through these instruments bears little resemblance to the pictures previously drawn from everyday experience. Clearly, purely internal thought processes, whether based on revelation or reason and supplemented solely by unaided sensory observation, provide a woefully inadequate mechanism for learning about the nature of the universe. It seems highly unlikely that we can hope to understand ourselves without paying close attention to the messages brought to us by the instruments of science.

Direct information about bodies and brains are provided by devices such as microscopes and MRI scanners. The latter have been especially important in indicating, to the consternation of many, that human thought may be the product of rather well-established natural processes that signal no new physics. Indeed, despite some recent attempts to find a special role for quantum mechanics in understanding consciousness, the data indicate that the brain operates almost exclusively in the domain of pre-twentieth-century Newtonian mechanics. At least, nothing we know at this time requires us to assume otherwise.

Quantum mechanics, of course, plays a role in the chemistry of living organisms. However, the principles involved are the same as those for the chemistry of a rock. So, the first thing we learn about ourselves from modern scientific instruments is that we are made of the same basic stuff as rocks and that life and mind require no special ingredients, material or immaterial. All they need is some carbon and other atoms with sufficient complexity to grow nonlinear structures and enough time for these structures to evolve into forms with sufficient complexity to exhibit the qualities we label as living and sentient. Computer simulations indicate that this type of behavior will develop naturally in sufficiently complex, nonlinear

systems regardless of platform.

While not trained directly on bodies and brains, modern telescopes continue to confirm the apparent insignificant status of humans in the totality of existence. Current cosmological theories based on telescopic observations indicate that even the billions and billions of stars and galaxies of Carl Sagan's "Cosmos" are but a tiny speck of dust in a far greater universe that extends beyond our visible horizon. And, although more speculative, the vast universe in which we live may be but one of countless many. Surely planet earth and its inhabitants can have little to do with the ultimate nature of reality. Any purpose we might find for our existence will have to be self-generated, a task that I see as neither impossible nor fruitless.

Data from modern physics likewise cannot be ignored if we wish to understand the human condition. Particle accelerators have revealed that the universe, though enormous in size, is at the same time remarkably simple in its basic structure. Matter is ultimately composed of a few basic particles called quarks and leptons. Material forces result when these particles exchange other particles called bosons. While this is undoubtedly not the final story, we have every reason to anticipate that future advances in knowledge will be even further simplifying.

The so-called laws of physics themselves, such as the great conservation principles of energy, momentum, and angular momentum that form the foundation of physics, can be understood as expressions of the symmetry and simplicity of nature. Complex structures emerge as a consequence of the uncaused, accidental breaking of the underlying symmetries. Thus complexity arises naturally out of simplicity. The new creationist movement that goes by the title "intelligent design" claims that this is provably impossible. Such claims are provably false.

In discussions of the human condition, many assumptions are made about the universe that are generally not even recognized as assumptions but taken as self-evident fact. Once again, these are the consequence of the tunnel vision of unaided human perspective. One such assumption, having profound consequences, is that time is some kind of river that "flows" from past to future, carrying us along with its strong, nondiverging current. Almost a century ago, Einstein showed that the traditional view of absolute time was wrong and that different

observers will measure different time intervals between events. Thus it is impossible to objectively define a moment "now" that is valid throughout the universe..

Even earlier, Boltzmann had suggested that the direction, or "arrow" of time was simply a convention that applies only to many body systems, such as the macroscopic systems of everyday observation. No arrow of time can be found in the equations of classical or quantum physics. The second law of thermodynamics is nothing more than a definition of the conventional time direction.

In 1948, Richard Feynman showed that antiparticles could be viewed as particles travelling backward in time. The highly successful theory of elementary processes that was developed subsequently, going today by the too modest name "standard model," makes no basic distinction between past and future or cause and effect. Although conventional time-directed language is often used in written descriptions, the more precise equations contain no such prejudice. Furthermore, experiments have found direct evidence for backward causality at the quantum level. It seems very likely that time is fundamentally reversible.

Boltzmann's arrow of time remains a valid emergent principle applicable to human experience. However, ultimately time has no direction and thus no beginning or end. At this level, cause and effect are interchangeable, and, as most interpretations of quantum mechanics imply, events can happen in the universe without cause.

Those who ponder human nature and the human condition cannot simply ignore the nature of humanity and its position in time and space as revealed by the instruments of modern physics and cosmology. They must cast off the traditions of thousands of years and accept that we are not special, indeed not at all important in the grand scheme of things. We are made of the same stuff as everything else, thrown together by accident and evolving according to no special purpose or plan in an underlying reality having no beginning, no end, and no distinction between past and future.

Our highly evolved cognitive capabilities enable us to comprehend this, but only after a huge

infusion of data from beyond pure sensory experience. As long as we continue to extend the frontiers of that experience, we can hope for further improvements in understanding ourselves. Ignoring the data from advanced scientific instruments and going back to relying solely on the data from everyday life will only result in a degradation of knowledge and a return to barbarism.

Thanks to Jonathan Colvin, Ron Ebert, Justin Lloyd, and Roahn Wynar for their comments.

Victor J. Stenger is Emeritus Professor of Physics and Astronomy at the University of Hawaii and Visiting Fellow in Philosophy at the University of Colorado. His latest book *Timeless Reality: Symmetry, Simplicity, and Multiple Universes* has just been published (Prometheus Books, 2000). He may be reached at vstenger@mindspring.com and his extensive web site can be found at <http://spot.colorado.edu/~vstenger/>.