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Letters Editors@sciam.com

IS IT ANY WONDER that "A Matter of Time," the September 2002 single-topic issue, brought out the pensive side of *Scientific American*'s readers? Letter writers reflected, often at great length, on the mysteries of time. "We presume to break time up into little units when we define hours, seconds and nanoseconds," wrote Pete Boardman of Groton, N.Y. "But time is not an object to be divided or a substance that moves. Time is the measuring stick, the ruler, the clock. It is earth rotating on its axis. It is earth orbiting around the sun. It is sand flowing through a narrow hole in an hourglass, the repetitive swing of a pendulum, the decay of cesium atoms." Some even turned to poetry to express their reactions, such as the first of the



other musings that await on the following two pages, for those who care to take the time.

EVERYTHING AT ONCE

In your enjoyable issue, I was particularly fascinated by the description of one theory, which holds that everything may actually be happening at once ["That Mysterious Flow," by Paul Davies]. I described this notion to my colleague Joe A. Oppenheimer of the University of Maryland, and he referred me to a poem by T. S. Eliot, "Burnt Norton," which begins:

Time present and time past Are both perhaps present in time future, And time future contained in time past. If all time is eternally present All time is unredeemable. What might have been is an abstraction Remaining a perpetual possibility Only in a world of speculation.

If the theory is eventually accepted, this may be a rather spectacular example of life imitating art.

> Norman Frohlich I. H. Asper School of Business University of Manitoba

Faced with the unintuitive outcomes of time as defined by Einstein a century ago, I have found that it makes sense to think of motion as the more fundamental quantity than time. The common physics equation velocity = distance/time would be better written, I submit, as time = distance/ velocity. The implication is that time is a derived (man-made) quantity that is the ratio of these two fundamentals. With this adjustment, many phenomena become more intuitive. While it seems strange to think of time slowing in the presence of a strong gravity field (general relativity), it is much easier to think of molecules slowing under the same conditions. Time travel also becomes easier to evaluate: because there is no time, there is no place to travel to.

> Andy Hanson Glen Rock, Pa.

While I read your articles, I alternated between being extremely frustrated and being fascinated. Why should an entity so common and so precious be so maddeningly elusive to understand in scientific terms? In our ordinary living, we all clearly understand the unidirectionality of time. Likewise, the field of engineering is based on spatially varying and ratedependent phenomena. Is it only theoretical physics and quantum theories that have a problem defining time? Finally, there must be profound spiritual content in our contemplation of time. How else could we embrace the notion of "always was and always will be" and eternity?

> Charles E. Harris NASA Langley Research Center Hampton, Va.

TIME FOR PHILOSOPHY

Philosophy can be useful to the understanding of physics for the same reason that science scholars often shun the subject. Namely, physics deals with exacti-

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Contact us for a consultation 212.451.8859 or jabbate@sciam.com tudes, while philosophy is based on a preponderance of available evidence. So, whereas an entire theory in physics can be invalidated by as little as a single erroneous digit, it is much harder to totally discount a philosophical argument. Isidor Farash

Fort Lee, N.J.

In "That Mysterious Flow," Davies argues that the passage of time may be an illusion. When he suggests that knowing this may eliminate expectation, nostalgia and fear of death, I think he is going too far. Physicists love to point out that we shouldn't try to use our everyday knowledge and experience to understand things

like cosmology or nuclear physics. But the argument also works in reverse. Everyday matters such as life and death may be best understood using common sense rather than esoteric cosmological theory. How exactly does Davies propose to eliminate our apprehensions and our

sense of living in the present? It seems to me that scientists increasingly try to make obscure theories seem more relevant to our everyday lives by making statements like this, which turn out to be pretty meaningless.

> Paul Bracken Martinez, Calif.

I was intrigued by two claims made in your issue. The first: that physicists "who have read serious philosophy generally doubt its usefulness" ["A Hole at the Heart of Physics," by George Musser]. The second: that "clock researchers have begun to answer some of the most pressing questions raised by human experience in the fourth dimension. Why, for example, a watched pot never boils" ["Times of Our Lives," by Karen Wright].

As a professor of philosophy, I thought that I might be useful by addressing that watched-pot question. So I called my



melt, at which point it would no longer be a pot. Consequently, a pot, let alone a watched pot, could never boil.

One of my sons was asked once whether he had ever taken a philosophy class. He responded that his life was a philosophy class. I regret that as a philosopher I cannot

contribute much to pressing science questions, except perhaps teaching young people how to think carefully. Do you think science can find such young people useful?

Murray Hunt

Brigham Young University–Idaho

TROUBLE WITH TIME MACHINES

Paul Davies oversimplifies the so-called twin paradox in "How to Build a Time Machine." He states that Sally, after having made a round-trip to a distant star, would return younger than her twin brother, Sam. This is a curiosity but not a paradox. The real paradox is that according to special relativity, while Sally is traveling at near light-speed, both twins would see each other as aging more slowly, because both frames of reference are equally valid. So who would be older when Sally returns?

The resolution lies in general relativity, which tells us that Sally will experi-

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ence additional time dilation as a result of her acceleration and will therefore be younger when the twins are reunited. Edward Hitchcock

TIME OUT

I was distressed that "Real Time," by Gary Stix, lent credence to the ridiculous concept of Internet time, a name given by Swatch to the simple translation of the Greenwich Mean Time standard established in 1884. Coupled with an unusable 1,000-unit division, this absurd marketing ploy is meaningless. If you go to your e-mail software, select "source" in the menu and read the headers of most emails you've received, you will find the GMT standard being used in most of them to synchronize the time differences. Therefore, we can state that Internet time, as well as the standard used around the world, is the venerable GMT.

> Hector Goldin Via e-mail

SPREAD SPECTRUM'S SECRET

Experience shows that spread spectrum won't work as advertised by "Radio Space," by Wendy M. Grossman [News Scan]. As a space-hardware developer and IEEE senior member, I have been involved with numerous modes of spread spectrum since the 1950s. Frankly, all of them can be jammed either by a carrier frequency near their center frequency or by any signal generating slightly more total power than they do. The only way out is frequency hopping. But other "hoppers" in the area can still jam that frequency. This is a dirty little secret of the communications industry.

Robert Wilson Big Lake, Alaska

ERRATA Andrewes ["A Chronicle of Timekeeping," by William J. H. Andrewes] edited *The Quest for Longitude* and co-wrote *The Illustrated Longitude* with Dava Sobel.

A tuning fork vibrates 44, not four, times per tenth of a second ["Instantaneous to Eternal," by David Labrador].





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