

TIME

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Edwin F. Taylor

I've completely solved the problem. My solution was to analyze the concept of time. Time cannot be absolutely defined, and there is an inseparable relation between time and signal velocity.

—Albert Einstein, May 1905, to his friend Michele Besso

Now Besso has departed from this strange world a little ahead of me. That means nothing. People like us, who believe in physics, know that the distinction between past, present and future is only a stubbornly persistent illusion.

—Albert Einstein, 21 March 1955, in a letter to Michele Besso's family; Einstein died 18 April 1955.

THE LONG VIEW:

Time (and space) came into being with the Big Bang. Current cosmology predicts that our visible Universe will expand indefinitely, dispersing the visible stars from the night sky around our present location. However, in a mere two to four billion years, “our present location” will become uninhabitable:

TERRA COTTA

When the sun reaches the eleventh hour of its life, it will swell to the size of Earth's present orbit, causing Mercury and Venus to burn up like giant meteors. Earth will escape this fate because the sun will have blown out some of its material, weakening its gravity so that our planet slips into a new, larger orbit. The ocre-red sun will fill the noon sky [from horizon to horizon]. As one edge sets in the west, the other will begin to rise in the east. Though cooler than today (2,000 kelvins rather than 5,800 kelvins), it will still bake the planet's surface to a nice hard finish. . . .

The sun will eject its outer layers in an extreme version of the present-day solar wind. Eventually the red behemoth will be stripped to its core, which will quickly settle down as a white dwarf star. Lit by this blue-hot pinprick, objects on Earth will cast sharp-edged, pitch-black shadows; sunrise and sunset will take no longer than an eyeblink. Exposed rock will turn to plasma as ultraviolet radiation from the dwarf destroys all molecular bonds, coating the surface with an eerie iridescent fog, constantly lifting and swirling. As the dwarf radiates away its energy, it will fade into a cold, dark cinder. Thus, our world will end first in fire, then in ice.

--- Bruce Balik and Adam Frank, *Scientific American*, July 2004, page 56

BOX 6.1. What Then Is Time?

What then is time? If no one asks me, I know what it is. If I wish to explain it to him who asks me, I do not know.

The world was made, not in time, but simultaneously with time. There was no time before the world.

—St. Augustine (354–430 C.E.)

Time takes all and gives all.

—Giordano Bruno (1548–1600 C.E.)

Everything fears Time, but Time fears the Pyramids.

—Anonymous

Philosophy is perfectly right in saying that life must be understood backward. But then one forgets the other clause—that it must be lived forward.

—Søren Kierkegaard

As if you could kill time without injuring eternity.

Time is but the stream I go a-fishing in.

—Henry David Thoreau

Although time, space, place, and motion are very familiar to everyone, . . . it is useful to distinguish these quantities into absolute and relative, true and apparent, mathematical and common.

—Isaac Newton

Time is defined so that motion looks simple.

—Misner, Thorne, and Wheeler

Nothing puzzles me more than time and space; and yet nothing troubles me less, as I never think about them.

—Charles Lamb

Either this man is dead or my watch has stopped.

—Groucho Marx

“What time is it, Casey?”

“You mean right now?”

—Casey Stengel

It's good to reach 100, because very few people die after 100.

—George Burns

The past is not dead. In fact, it's not even past.

—William Faulkner

Time is Nature's way to keep everything from happening all at once.

—Graffito, men's room, Pecan St. Cafe, Austin, Texas

What time does this place get to New York?

—Barbara Stanwyck, during trans-Atlantic crossing on the steamship *Queen Mary*

Down Time's quaint stream
Without an oar
We are enforced to sail
Our Port a secret
Our Perchance a Gale
What Skipper would
Incur the Risk
What Buccaneer would ride
Without a surety from the Wind
Or schedule of the Tide –

-- Emily Dickinson, No. 1721, Variorum Edition, ed. R. W. Franklin, Harvard Univ. Press, 1998

REFERENCES

“How to make time expand,” Keith O'Brien, *Boston Globe*, September 9, 2012

“Fast time and the aging mind,” Richard A. Friedman, *New York Times*, July 20, 2013

Forrest Church quote from his introduction to the Beacon Press edition of *The Jefferson Bible*.