Time, **Science, and Faith,** Doug Hayhoe, March 2024

Time is common but mysterious. We can look at it from both a science and a faith perspective.

On my first trip to England, I made sure to visit Stonehenge. In his book, *Stonehenge Decoded* (1965), the astronomer Gerald Hawkins had proposed a controversial idea. Stonehenge was a computer used by ancient peoples to predict future alignments of sun and moon (i.e., an eclipse predictor). So, I just had to see it for myself! In subsequent years, I returned several times (Figure 1).

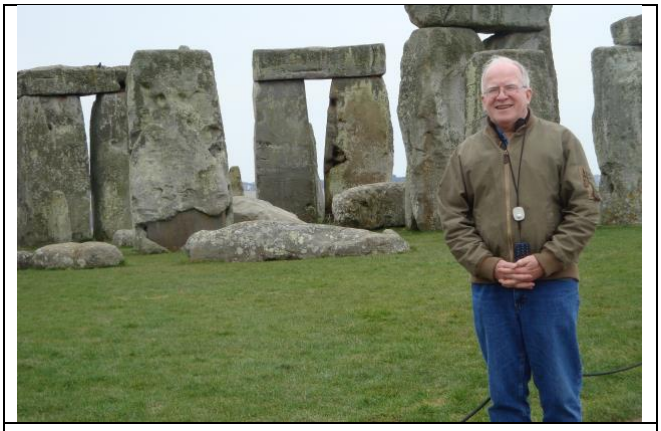

Figure 1 A repeat visit to Stonehenge in 2009

Whether or not Stonehenge was an ancient eclipse predictor, it kept careful track of the of the Sun and Moon. From the beginning of history, people marked days, months, and years by the Sun, Moon, and stars. Sundials, which date to 1500 BC, helped people measure parts of a day. And water clocks, which date to 600 BC, measure even smaller amounts of time, such as minutes, and perhaps even seconds.

A science perspective on time

The Scientific Revolution

The accurate measurement of time was critical to the Scientific Revolution. Galileo used it to establish the acceleration of gravity common to all falling objects, which he wrote about in 1638. Isaac Newton later used Galileo's results to formulate the theory of universal gravitation.

When Galileo tried to measure the acceleration of gravity of falling objects, however, he found that they fell too quickly to get good time measurements. So, he slowed down their motion, by rolling metal balls down an inclined slope, and using water clocks to measure the different times.

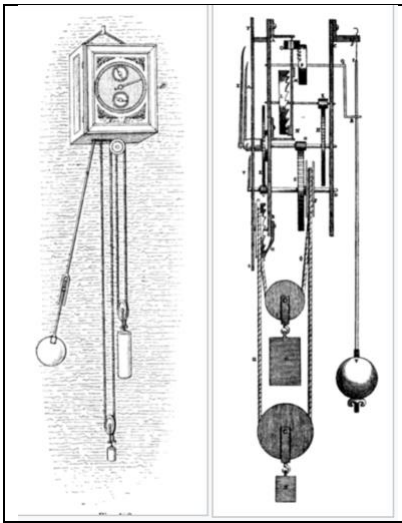

Figure 2a Huygens' pendulum clock and drawing

Figure 2b Our living room clock today

When I taught physics many years ago, we tried to replicate Galileo's experiments, using water clocks like he did. The results were abysmal! (More careful replications by others have yielded better results.) I later found out that Galileo also used other devices to measure time, such as the pulsilogon, a pendulum-like clock.

Another prominent figure of the Scientific Revolution was the Dutch physicist Christiaan Huygens. Among his many discoveries and inventions was the pendulum clock, in 1656. This became the most used time piece for several centuries, and in fact is still used today (Figure 2).

The high point of the Scientific Revolution was the publication of Newton's *Principia* in 1687. It was the greatest physics book ever written. (See my essay, *Isaac Newton*.) In a General Scholium to the book, he gave his view of time. Relative time is measured in hours, days, and years, but absolute time flows at a constant rate through the universe, and is unrelated to space or motion. This view dominated physics for 200 years. Many further inventions of clocks took place. But no major changes occurred in our understanding of time. Until Albert Einstein came along, that is!

The advent of modern science

I fell in love with physics in high school. But it was all classical physics. I couldn't wait for university where we also studied modern physics, such as Einstein's theories.

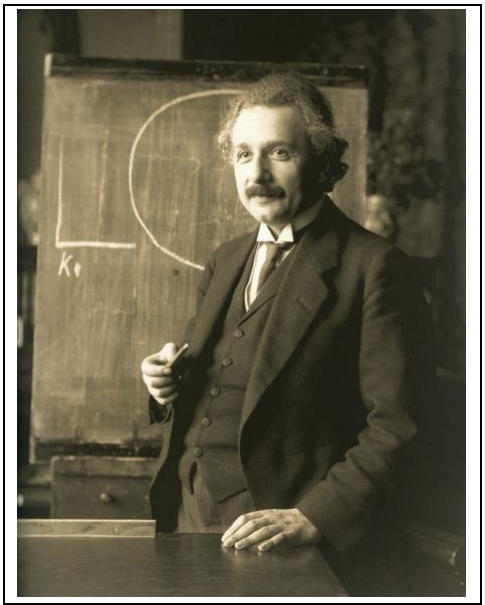

Figure 3 Albert Einstein during a lecture in Vienna in 1921 (photo by Ferdinand Schmutzer).

In 1905, Einstein (Figure 3) shocked the world with his special theory of relativity. He said we should not think of space and time as two separate entities. Rather, we should consider space-time to be one four-dimensional entity that involves both space (x, y, z) and time (t).

He also predicted that when someone travels at a very high speed, time for them slows down. Picture two twins. One stays home, while the other goes on a journey, moving at a speed near that of light. When she gets back, the clock she took along only records that one year has passed. But the twin who stayed home has aged 50 years.

Scientists tested this in 1971, using atomic clocks. One set of clocks went into space, orbiting Earth at high speed (but nothing like that of light). Another stayed behind. When they were reunited, the clocks from space were a tiny amount behind. But special relativity had already been universally accepted.

In 1916, Einstein proposed his general theory. Time not only slows down when we're moving fast; it also slows down when we're in a gravitational field. This also was proven scientifically.

Einstein was still alive when Stephen Hawking was born. Hawking further elaborated on Einstein's theories. The general theory of relativity had predicted that the gravitational field at the centre of a black hole is so severe nothing can escape. But in 1974, Hawking proved that black holes can still emit radiation. He also pointed out that from the perspective of an outside observer, a person falling into a black hole would appear to be "frozen in time."

In 1988, Hawking wrote his best-seller, *A Brief History of Time* (1988). In chapter 8, he suggests that the universe may have no beginning or ending in time: time and space only exist with the universe. Sixteen centuries earlier, Saint Augustine had said something similar: time didn't exist before the universe was created. (See my essay *The Legacy of Saint Augustine.*)

Physicists and philosophers still have many unanswered questions about time. Why does time only move in one direction, forward? Will time ever end? Is time just an illusion? If you're interested, you can find many YouTube videos and magazine articles (i.e., in *Scientific American* or *New Scientist*) on these questions and others, by respected physicists and philosophers.

A faith perspective on time

The Old Testament perspective of Moses and the prophets

People in the Bible, like others, used days, lunar cycles, constellations, and even sundials to mark time (Genesis 1:14-17; Job 38:31; Isaiah 38:7). But what was different about them was this. By faith they grasped the truth revealed to them that an infinite-personal God exists outside of time. Moses referred to him in several places as the Eternal God (Genesis 21:33; Deuteronomy 33:27). And Moses' famous poem on time begins by saying, "Before the mountains were born or you brought forth the whole world, from everlasting to everlasting you are God" (Psalm 90:2).

Moses also lamented the brevity of life, with its unfulfilled dreams (Figure 4). He no doubt wrote Psalm 90 after seeing multitudes of Israelites die in the desert: "You turn people back to dust (v. 3)," he complained to God. "We are consumed by your anger (v. 7)." But even in this, Moses learns a lesson: "Teach us to number our days, that we may gain a heart of wisdom (v. 12)."

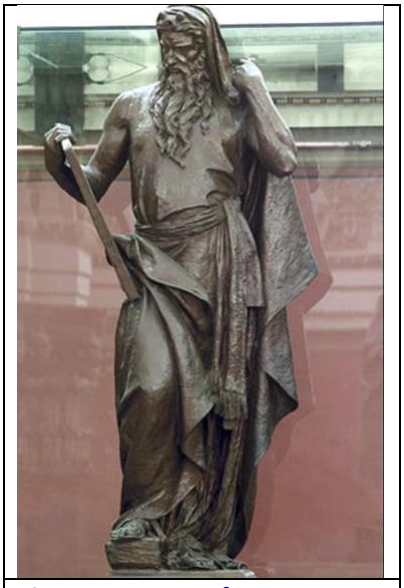

Figure 4 Statue of Moses at the Library of Congress.

Moses and other Old Testament people also believed that our brief life is more meaningful when we enjoy a relationship with the Eternal God, by faith. For he is not only an infinite God, but also a personal God, who wants to be in relationship with us. Thus, Moses ends Psalm 90 with this prayer: "Satisfy us in the morning with your unfailing love, that we may sing for joy and be glad all our days … May the favor of the Lord our God rest on us; establish the work of our hands" (vv. 14-17)."

The New Testament teaching of Jesus and the apostles

New Testament Christians had the same three perspectives on time as the Israelites in the Old Testament. The Eternal God is outside of time, human life is brief but meaningful, and we can enjoy a personal relationship with God in this life, by faith. See, for example, Hebrews 11:3, 6.

There were glimpses in the Old Testament of eternal life for humans, it's true. The well-known Psalm 23, for example, concludes with, "and I will dwell in the house of the Lord forever." See also Psalm 16:11, Psalm 133:3, and Daniel 12:2-3. But these references were not always clear.

When Jesus came, he taught clearly about eternal life and the resurrection. One day, for example, the Sadducees challenged him. They were rationalists, who didn't believe in the resurrection, but still followed the patriarchs, Abraham, Isaac, and Jacob. So, Jesus reminded them of what happened to Moses, in Exodus. "In the account of the burning bush, even Moses showed that the dead rise, for he calls the Lord 'the God of Abraham, and the God of Isaac, and the God of Jacob.' He is not the God of the dead, but of the living, for to him all are alive" (Luke 20:27-38).

In other words, although Abraham, Isaac, and Jacob had all died hundreds of years before Moses, they were still living, for the God whom they believed in is "the God of the living." This is profound. If we believe in the Eternal God as our God, we will continue to live in relationship with him forever. For the infinite-personal God is not the God of the dead, but of the living.

Canadians are probably less religious than Americans, on the average. Thus, it was interesting to read a new report by Cardus and the Angus Reid Institute that found that 60% of Canadians believe in life after death, while "only one-in-eight Canadians rule out the possibility of life continuing after death entirely." And these figures haven't changed much since the 1960s.

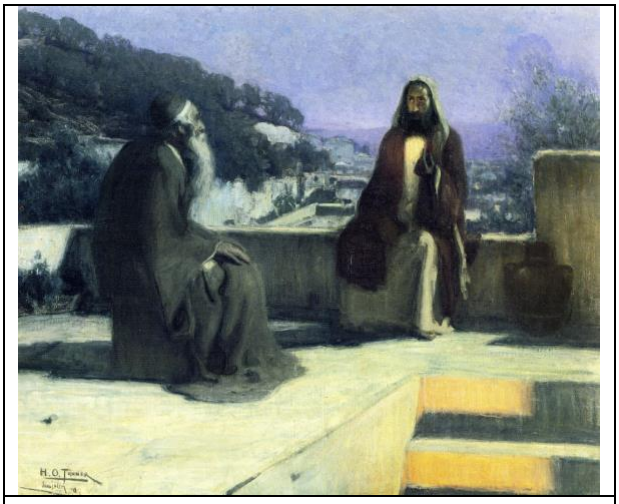

Figure 5 Nicodemus visiting Jesus. 1899 painting by Henry Ossawa (public domain)

Throughout the New Testament, the expression "eternal life" is used forty-four times. Jesus and his apostles taught that God's intention is to give eternal life to all who believe in Christ. The most well-known verse is John 3:16, which Jesus taught Nicodemus, the Jewish ruler, who came to him one night (Figure 5): "For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life."

It's true that eternal life means more than life after death, or a life without end. It also means "the life of the Eternal God." But this new life that a believer receives will also last forever, even as God endures forever, outside of time.

New Testament authors used two Greek words for time. Chronos, from which many English words are derived, refers to the passage of time in days and years. Kairos refers more to an opportune time or appointed time. When Jesus' brothers asked him why he wasn't going to the feast in Jerusalem, Jesus replied, "My time has not yet come" (John 7:6). He used kairos here, because he was referring to his appointed time to go to Jerusalem to die on the cross.

The cross and resurrection are at the centre of a Christian understanding of time. They happened once for all and for all time. It's only because of Jesus' death and resurrection that humans can receive the gift of eternal life. (The explanation of this would take another essay.)

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The ultimate answer, then, to the sad brevity of our human life, is to believe in the Eternal God who is outside of time, both God the Father and his Son Jesus Christ. We will then receive a new life that is not be bound by time, eternal life.