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TIMEKEEPING

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WHY WE NEED CLOCKS AND CALENDARS

By David Christian, adapted by Newsela
All life forms come with their own way of keeping track of time. However, no other species does it better than humans. We have more ways of marking time, and we do it more precisely.
Why bother to keep time?

Why do we need clocks and calendars? The answer may seem obvious. Nowadays we need to know what others are doing and when they’re doing it. We also need to know what’s happening in nature. It’s important to know what season it is, for example. If you didn’t know the time or date, you’d be seriously out of sync with your world. You’d miss a train or walk in late to your Big History class.

But it’s not just modern humans who need to keep track of time. All living things must know the time to adjust to their environment as it changes. Bears know when to hibernate. When winter is over, they know when to wake up. Plants know when to blossom. Many birds know when it’s time to head south for the winter.

Keeping track of time is critically important. It’s so important that evolution has given us clocks in our body. Our body clocks are sensitive to daylight and the seasons changing. These are known as “circadian rhythms.” Your body clock tells you it’s not a good idea to get up at 2 a.m., when it’s pitch dark.

What’s different about human time?

We humans track time differently than other creatures. Human societies have become larger and more complex. We have become more precise at marking the time. The Olympics need extremely accurate clocks. We also need to schedule our daily work. We can even date geological events that happened billions of years ago. To do this, modern humans have designed sophisticated clocks, calendars, and timetables. It wasn’t always this way.
Keeping time in the Paleolithic era

If you were a Paleolithic forager living 100,000 years ago, how would you have kept track of time? We have little direct evidence about Paleolithic time-tracking. However, we can study modern foraging societies for hints.

The rhythms of the natural world are critical in a foraging society. You need to track the changing seasons. And you need to follow the schedules that other species keep. Then you can decide when to move to a new campground, what plants to collect, and what animals to hunt. Modern foragers are more sensitive to these changes than any city dweller could be.

Keeping track of the time of day and the time of year was not difficult in early societies. Ancient people typically spent most of their time outdoors. They could watch the positions of the Sun and the stars. Planning activities with family and friends was much less complicated than it is today. Back then people lived in small groups and met face to face.

Tribes might meet other tribes based on the season. There was no need for precise scheduling. Maybe one tribe met with a neighboring tribe “when the reindeer returned.” So, it didn’t really matter if their schedules were a few days off. Foraging societies were much more flexible about appointments than we are.

South Africa’s Blombos Cave was lived in by humans as early as 100,000 years ago. Archaeologists found chunks of ochre (an orange/red rock) with strange marks on them in the cave. These rocks date back 70,000 years. They are the oldest known “artworks.” It’s possible that the engravings were used to mark the passing of time. Perhaps the markings tracked the Moon or important rituals.

More evidence of early calendars comes from about 40,000 years later. The American archaeologist Alexander Marshack (1918–2004) became fascinated by marks on Paleolithic objects. He was sure that some of them were simple calendars that tracked the Moon’s movements. In 1964 he visited Les Eyzies, a prehistoric site in France. Here’s what Marshack saw:

As [the Sun] was going down, the first crescent of the new Moon appeared in the sky as a thin silver arc. It was facing the sinking Sun. It was instantly apparent that the Les Eyzies horizon formed a perfect natural “calendar.” The first crescent would appear over those hills at sunset every 29 or 30 days...One could tell that the Sun was sinking at its farthest point north on that horizon, its position at summer solstice. It would now begin to move south.... There was no way that generations of hunters living on that shelf over a period of 18,000 years or more could fail to notice these periodic changes and movements of the Sun and Moon....

Keeping time in agrarian societies

Agricultural societies began to appear about 11,000 years ago. As they expanded, they connected with their neighbors. Now they needed more reliable methods of keeping time. If you wanted to sell vegetables in a nearby town you had to know when the markets were held. To plan your travel to the markets you needed the time in advance. Drifting in a week or two later no longer cut it. Now you needed calendars that everyone agreed on and shared.

Similarly, seeds were planted at particular times. The harvest was also collected according to seasonal calendars. These early calendars were based on Earth’s orbit around the Sun.

This is why new devices began to appear that could track time more precisely. One method of timekeeping was to watch the Sun’s shadow using sundials. A stick in the ground was a simple sundial. Of course the Sun had to be shining. But some sundials were extremely precise.

Time was also kept through an invention called an hourglass. It was a simple glass container with sand that flowed slowly through a narrow hole. You measured time by how long it took the sand to hit the bottom of the glass. Time could also be measured using water dripping from an urn.

More elaborate instruments were used to track the movements of the stars and planets. The famous Stonehenge rocks in England were constructed between 4,000 and 5,000 years ago. Stonehenge may have been designed to determine the exact dates of the summer and winter solstices. These events occur two times a year. They mark the days when the Sun reaches its highest and lowest points in the sky.

The most elaborate agrarian-era calendars were probably those of Mesoamerica. The Maya were one of the great civilizations of Mesoamerica. They created a 260-day calendar based on biweekly rituals. They also designed a 365-day version. It was organized around the agricultural and solar phases. One calendar even measured time from the beginning of their civilization.
Meanwhile, the Romans developed a calendar with 10 months. The names they used are familiar to us. For example, Martius is our March. Eventually, the Romans refined their calendar. They added two more months and even included the concept of a leap day.

**Toward the modern era**

In his book *Time: An Essay*, the German scholar Norbert Elias argued that as societies became larger and more complex, people needed more precise clocks. Human records became more accurate as well. Individual schedules linked together in more and more complex networks. As schedules linked up, people had to think about time more carefully:

The chains of interdependency in pre-state societies are short. People then didn’t experience past and future as being so distinct from the present. In people’s experience then, the immediate present stood out more sharply than either past or future. Human actions, too, tended to be more centered on present needs and impulses. In later societies, on the other hand, past, present and future are more sharply distinguished. There is a greater need and capacity to foresee the future. Thus considerations of a relatively distant future gain stronger and stronger influence on all activities to be undertaken here and now. *(Time: An Essay, p. 144)*

Improved methods of keeping time evolved in many different contexts. Monks needed to know when to pray, so they developed the ringing of bells. Travelers needed to schedule their departures and arrivals more carefully. Increasingly, elaborate clocks were built. Some used carefully controlled drips of water. Others used falling weights.

Precise clocks were particularly important for navigators. They needed them to calculate their longitude. Then they would know how far west or east they had traveled. Ships began to travel around the globe from the late 1400s. 18th-century English clockmaker John Harrison made the most precise clocks of his time.
More accurate timekeeping was now needed. In 1714, the British government offered a prize of £20,000 (about $5 million today) to the first person who could build an accurate clock. The clock would have to keep time within two minutes on long sea trips. Clockmaker John Harrison spent most of his life on the task. He finally won the prize in 1773, three years before he died.

In the nineteenth century, the invention of railways and steamships required even more accuracy. Now many more passengers could travel. More cargo could be shipped. On-time departures and arrivals were critical to the whole network. The first English train schedule was published in 1839. For the first time, different British cities needed to coordinate their clocks. Greenwich Mean Time (GMT) became the standard time in Britain. But GMT was not adopted throughout Britain until 1880. In the U.S., time zones were not standard until 1918. Around then, the idea of daylight saving was introduced in numerous countries.

Steamships were traveling from country to country. They needed precise coordination across the globe. It took until 1929 for most countries to start linking their local time to Greenwich Mean Time. But, the nation of Nepal waited until the 1980s to do so.

In today’s world, we need even greater precision. International plane schedules require extreme accuracy. Electronic transfers of money have to be timed precisely. So, ultra-precise atomic clocks were invented. They measure time using signals sent by electrons.

One final breakthrough in timekeeping was particularly important for Big History. That was the invention of “radiometric” dating. This technique can date past events by measuring the breakdown of radioactive materials.

Before about 1950, we mainly relied on written records of the past. These records only go back a couple thousand years. An American chemist developed radiometric dating to figure out the age of very old objects. His method used the breakdown of carbon to date things. New dating techniques have been developed since then. They can now reach back to the Big Bang, 13.8 billion years ago.

Accurate timekeeping and recordkeeping are the foundation for histories of all kinds. This includes Big History. Next time you fly or take a bus, be grateful. Imagine if your pilot or driver let you off at your destination any old time in the next week or two!
Sources


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