

whY2K?

Narrator's Script

Introduction

The unceasing flow of time...

At the turn of the millennium, we have learned to subdivide time into seconds, milliseconds, nanoseconds: slivers of time millions of times shorter than our human perceptions can possibly register.

But long before people used levers and electrons to measure time, they created calendars. They organized cycles of days and seasons into the dates and numbers we use today. Now, our calendar is rolling over, from 1999 to 2000.

Time started counting up long ago,... So we may stop to ask ourselves, at this unique juncture, “why?” “Why the year 2000?” “WhY2K?”

Motions in the Sky

Calendars are as old as civilization. To understand our calendar, we must return to the place our ancestors discovered it—we must return to earth's night sky.

Modern observers tend to regard the night sky as a tapestry of brilliant lights arranged unchangingly overhead. But an evening's observation—a night spent carefully watching the stars—reveals a striking pattern. A

pattern our ancestors were acutely aware of, with their great dependence on the sky. Something we hardly notice.

The stars move.

In the course of a single night, stars rise slowly in the east, cross the sky, and eventually set in the west. Ancient star gazers certainly noticed this: it influences the position of the images they drew in the sky. We can watch the mighty hunter Orion, followed by his hunting dogs, as he pursues Taurus the Bull across the sky—and just as Orion sets in the west, his mortal enemy Scorpius rises in the east. Even the scorpion flees from the archer Sagittarius, following close behind.

Just as the stars in the sky appear to rise and set, so does the sun. Once every 24 hours, the sun makes its debut in the east, brightening the sky during our daylight hours, crossing to its highest point at noon, and then making the trek downward to the western horizon.

The cycle of darkness and light—of day and night—forms the basis of every calendar system.

But a careful observer will notice many patterns in addition to the obvious day–night cycle. In particular, the moon’s changing face became a touchstone for ancient observers. From one night to the next, the moon first grows—or waxes—then shrinks—or wanes. From new moon to first quarter to full moon to third quarter back to new, the moon takes 29 and a half days to go through its phases.

The moon thus gives us the next fundamental period of time: the month.

Over time, our ancestors noticed yet another, more subtle change that took place in the sky. From night to night, month to month, *different* constellations make their appearance at night. Sagittarius and Scorpius show up in the summer night sky, while Orion and Taurus appear during winter evenings. At any given time of year, some constellations are not visible at all—obscured by the brilliant light of the sun.

This long progression of constellations takes one full year—a little over 365 days—to complete. Careful observers learned to count out these days and created the first calendars.

Solar and lunar cycles don't line up precisely, however: the 29 and a half days of a lunar month do not fit evenly into the 365 days of the solar year. A calendar based on the moon will shift by about eleven days each year. But a calendar based on the sun won't match the phases of the moon. Calendar makers had to select—or compromise—between the two.

Mediterraneans

In ancient Egypt, the Nile River flooded one season a year. This annual event provided water to grow crops in the dry, desert land. Predicting the time of the flood helped the Egyptians regulate their resources, so they learned to watch the sky for a pattern that would repeat every year.

Egyptian astronomers noticed that the bright star Sirius, in Orion's hunting dog, made its first appearance just before sunrise at the same time each year—just before the Nile River flooded. Sirius's emergence from the glare of the morning sun marked the beginning of the Egyptian calendar.

By keeping track of Sirius's position from year to year, the Egyptians also determined a fairly accurate length for the solar cycle—about a quarter of a day longer than 365.

When Julius Caesar conquered Egypt, he learned from the Egyptians' precision and corrected the Roman calendar. Under the old system, Roman astronomers would frequently make their calendar longer or shorter for political reasons—to keep one ruler governing longer or to cut short a rival's term in office. The beginning of the year had slipped from the winter into the fall!

To institute a new system, Caesar created one last "Year of Confusion," which lasted a full 445 days. The new "Julian" calendar used months of 30 or 31 days each, and an especially short February that gained a day every fourth or "leap" year. Caesar managed to create an accurate calendar for everyday people—people who weren't astronomers and didn't hold political power.

By Caesar's original calendar, which counted days from the time Rome was founded, our January 1, 2000, would be December 15, 2753.

Mesoamericans

Across the Pacific Ocean, in what is now Mexico and Central America, the Maya and their predecessors had worked out a calendar even more precise than Caesar's.

The Maya actually used two separate calendars—one, a 365-day “civil” calendar, and another 260-day “ceremonial” calendar. We do the same thing with our seven-day week: months and years don't always start on the same weekday, but we don't mind, choosing to use both cycles for different purposes.

The Maya based their calendar on complicated rules to keep it in line with the sky. They used the sun, moon, and stars, of course, but their ancient texts also list the appearance and disappearance of the planet Venus from the sky. An extensive table of dates gave corrections over a period of 301 years to pinpoint the position of Venus.

By our modern calendar, the Mayans accurately predicted the appearances of Venus to within two hours over a period of five centuries!

Our January 1, 2000, comes 5,119 years after the Maya established their calendar.

Chinese

Like their counterparts in the Mediterranean and the Americas, Chinese astronomers also learned to balance the cycles of the sun and moon in their calendar. Careful record-keeping in a stable society that endured for

thousands of years enabled astronomers to uncover subtle regularities in the motions of the moon and planets through the sky.

Chinese calendars subdivided time into small pieces of varying sizes—usually 10- or 15-day weeks and 29- or 30-day months—and then grouped them into much larger systems.

For example, the Chinese noticed that Jupiter took 12 years to complete a cycle around the sky, moving through each of the constellation of their zodiac. When people today talk of the “Year of the Monkey” or the “Year of the Dragon,” the name refers to the constellation in which Jupiter appears that year.

The Chinese also noted the 60-year cycle that linked the motions of Jupiter and Saturn, the time it took for the two planets to rendez-vous in the same constellation, once in a human lifetime.

January 1, 2000, falls near the end of the 4,696th year of the Chinese calendar.

Where Do We Start?

Every culture constructed a calendar to fit its own interpretation of the sky. Different places, different seasons, different purposes.

Today, most societies use a common calendar—a modified version of Caesar’s. In the Middle Ages, the Christian abbot Dionysius Exiguus took the Roman calendar and gave it a new starting point—to coincide with

what he estimated as the year of Christ's birth, 531 years previous. Instead of 1265 by Caesar's calendar, the year became the year A.D. 531 in the new scheme. Although our calendar received another revamping in the sixteenth century by Vatican astronomers, its structure would be familiar to Julius Caesar himself.

For the Romans, the calendar began with the founding of Rome. For the Chinese, dates started with the beginning of their empire. For the Maya, the starting point of their calendar may have marked an important astronomical event—perhaps a day when Venus rose just before the sun, when the sun was highest in the sky. And the setting of our Western calendar is rooted in Christian religious traditions.

The basis of every calendar lies in the motion of the sun, moon, and planets—motions that we have learned to predict with unparalleled accuracy. But the ways of measuring the passage of time depend on arbitrary choices made thousands of years in the past.

“WhY2K?” Why not?