

## Tracking Time

As poetic and carefree as living by the broad strokes of Nature may seem now—and how experiencing the "simpler life," often ascribed to rising at dawn and retiring with night's fall, may be yearned for—man's tracking of time arose out of necessity: out of the difference between survival and death.

A sense of how much light remains in a day in which to complete a task or a journey is now usually a matter of convenience or preference; but in earlier times, it was crucial to the completion of a project or trip. Prior civilizations depended upon their ability to manage and control water for irrigation—which required the concept of time measurement—in order to sustain themselves. So, too, did the planting and harvesting of crops call for more sophisticated time organization than casual observations of the seasons. Similarly, the opportunity for success in securing food throughout the year, be it through hunting, gathering, and/or growing, was expanded as patterns in Nature could be more comprehensively understood, chronicled, and worked with. In spiritual and religious observations, time also played a role. The call for prayer, devotions, and observations of rituals were rooted in natural occurrences that could be charted and, eventually, predicted.

If necessity is the mother of invention, then sundials, the first known time-keeping devices (horologes), can be called her offspring. Societies around the world created or used them with varying degrees of complexity. Often the history of a people or empire can be traced by noting the influence of another, more knowledgeable one on it—and often the presence and evolution of the sundial was evidence of this cultural interaction.

Sundials have been found throughout the world. The Inca and Aztec societies in the Americas used them; the Arabs were known for their complicated ones. The sundials created by the Saxons were based on those created by the Vikings, who made the divisions on them based upon the tides.

Archaeologists have discovered sundials in Egypt that can be dated back to around 1500 BC. The early Egyptians segmented a "year" into 365 "days" and divided the period between sunrise and sunset into twelve equal intervals, regardless of the season—and the resulting length of the day. These first sundials consisted of a horizontal bar with a north-south alignment. As the sun rose in the east, a shadow was

formed to the west of the bar; at midday, it crossed the bar, and as the sun traversed the sky on its afternoon trek, the shadow fell to the east.

Historical writings dating back to mid-400s BC cite that the Greeks acquired their knowledge of sundials from the Babylonians. The Greeks are credited with devising the upright pole, called the gnomon (Greek for "pointer"), which is still used on sundials today. The shadow cast by the pole fell onto and rotated within concave cones.

Not as advanced in their study of horologes, the Romans picked up much of their knowledge from the Greeks. Evidence of the sundial's importance in everyday life appears in early literature: one of the characters in Aristophanes' *Ecclesiazusae* says that he "determines dinner time by the length of the gnomon's shadow." Eventually, both the Greeks and Romans created beautiful time-keeping devices that were placed in homes and public places such as temples and baths. In the mid 40s B.C., Cicero wrote in a letter that he wanted a sundial at his villa in Tusculum. About thirty years later, the Roman emperor Augustus imported a 71.5-foot, 230-ton obelisk from Egypt to use as a pointer. (This was excavated and carefully re-erected in the 1700s.)

A big advancement for the sundial came after the advent of Christianity. It was at this juncture that the discovery was made that if the gnomon were slanted toward the celestial North Pole, the track of the cast shadow would follow a repeatable pattern of the sun. Prior to this revelation, the shadow of the vertical gnomon would trace out different hours during the course of the year because of the sun's varying orbit. With this new understanding, it was possible to calculate where the approximate hours should fall, regardless of whether the sundial had a vertical or a horizontal face. (Ptolemy is credited with formulating these calculations.)

For centuries, the duration of the days' hours varied with the season. The early English Monk Bede (673?–735 A.D.) recorded this in his writings. It is believed that the concept of dividing the day into equal hours was not adopted until the 13<sup>th</sup> century.

Europe's first contribution to the tracking of time was significant: Copernicus (1473–1543) transformed the science of astronomy when he posited that the sun—not the earth—is the center of our solar system. Once accepted, this revelation piloted the path to a clearer and deeper grasp of seasons and solar time.

Even though clocks came into being in the 1200s, it took about 300 more years until mechanical timekeeping devices became prevalent enough to threaten the persistence of sundials. But even when watches were made in large numbers in the 1800s, sundials continued to be popular. It was in the next century that it became obvious that if sundials were to avoid extinction, they would have to overcome some of their vagaries. With this accomplished through refinements, sundials remained popular and the means by which to set the still-unsophisticated and often unreliable clocks and watches. But because of technological advances—paired with simple geography—their tenure became limited.

Due to longitudinal position, sundials a few miles apart will give different times. (Think back to the early Egyptian sundials with the horizontal bar: of two sundials, the more eastern one will show an advance time because the sun gets to it first.) When people did not travel much, a disparity often of fifteen minutes between locales was not of significant consequence.

However, late in the 19<sup>th</sup> century, the discrepancies in time due to position *did* begin to matter because of railroads. These railroads required schedules ..... but whose? Along any given 100-mile route, there could be a half-dozen or more different clocks, in different cities, all showing different times. Since passengers and trains required consistency to set departures and schedules, these variances had to be eliminated. To this end, in 1884, the United States was divided into four zones (each 15°). All train stations within a zone had the same time. "Train time" was rigorously held to, and people began setting their clocks by the whistle or passing of regular locomotives. Hence, the sundial became pretty much relegated to adorning gardens and evoking images of an era past.

From the epoch when time was comprehended and measured with vagueness and imprecision, we have come to micro-manage it to microscopic fractions of seconds . . . or is time managing us?