Introduction

> What then is time? I know well enough what it is, provided that nobody asks me; but if I am asked what it is and try to explain, I am baffled.[1]

St. Augustine's (354–430) question – How to conceptualize something so ordinary and transparent as time? – has bedeviled scientists, philosophers, and social scientists from his era to ours. In his recent and immensely popular *A Brief History of Time*,[2] Stephen Hawking spelled out the revolutionary implications of Albert Einstein's (1879–1955) theory of relativity. In contrast to Isaac Newton (1643–1727), who considered time an objective aspect of the natural world, an absolute background unchanged by motion or matter, Einstein proposed a new relativistic model in which clocks ran slower or faster depending on their speed or location. The sociologist Emile Durkheim (1858–1917), a rough contemporary of Einstein, offered a parallel theory of temporal relativity – an argument about time from the social rather than from the cosmological perspective. Following Kant, Durkheim contended that the basic categories of the understanding (including, of course, time) were not given a priori but were social constructs.[3] Edmund Leach, the anthropologist, wrote, "We talk of measuring time, as if it were a concrete thing to be measured, but in fact we create time by

[1] Augustine, *Confessions and Inchiridon*, ed. and trans. Albert Cook Outler (Dallas: Library of Christian Classics, 1955), book 11, ch. 14.
[2] Stephen Hawking, *A Brief History of Time* (New York: Bantam Dell Publishing Company, 1988).
[3] Norbet Elias, *Time: An Essay*, trans. Edmund Jephcott (Oxford: Blackwell, 1992), 4. For an interesting overview of the various sociocultural approaches to time, see Peter Burke, "Reflections on the Cultural History of Time," *Viator: Medieval and Renaissance Studies* 35 (2004): 617–26.

creating intervals in social life. Until we have done so there is no time to be measured."[4] The relationships between things and activities are described in terms of time (and, of course, space) but time itself is not another economic resource to be conserved or wasted.

Although there are many ways of approaching the topic of time, the social or cultural point of view is the one taken here. From this perspective, there were three dimensions to Islam's radical restructuring of the temporal system: the calendrical, the ceremonial, and the chronological. The rest of this chapter briefly describes the origin and early development of the Islamic system – from its beginnings under the prophet Muhammad (ca. 570–632) to its final form at the end of the Abbasid empire (750–1258) – with a special emphasis on the radical nature of the new concept. Setting the stage for what follows, this introduction provides for each chapter a background, against which the characteristic contour of the individual temporal dimension – calendrical, ceremonial, or chronological – can be identified.

CALENDRICAL

In premodern societies, the most common units of time – the day, the month, and the year – were defined by the three great natural timekeepers – the earth, the moon, and the sun.

The rotation of the earth on its axis established the first natural division – light and dark – and the twenty-four-hour period was the shortest unit of the natural clock. Most societies further divided the daylight hours by the apparent movement of the sun across the sky. Because the axis of the earth was tilted at 23.5 degrees, the amount of light in a twenty-four-hour period varied with the seasons (except at the equator). Only at the equinoxes (equal nights) – the Vernal (21 March) and the Autumnal (21 September) – were day and night exactly twelve hours each.[5]

The second natural timekeeper, the moon, revolved around the earth and cycled through its phases in approximately 29.5 days. The interesting thing about the moon was the way its shape changed. When directly between the earth and the sun, it was invisible; as it orbited, however, it

[4] Janet Hoskins, *The Play of Time: Kodi Perspectives on Calendars, History, and Exchange* (Berkeley: University of California Press, 1993), 373. A comprehensive look at the various methodologies employed by anthropologists can be found in Nancy D. Munn, "The Cultural Anthropology of Time: A Critical Essay," *The Annual Review of Anthropology* 21 (1992): 93–123.

[5] Beulah Tannebaum and Myra Stillman, *Understanding Time: The Science of Clocks and Calendars* (New York: Whittlesey House, 1958), 93–4.

waxed, became full, and then waned to a sliver, disappearing entirely. The cycle was repeated again and again. Because these changes – from sliver, to half, to full, and back again – were so readily apparent and since the approximately thirty-day period mimicked other natural intervals – the female menstrual period and the cyclic behavior of certain marine creatures – the cycle assumed great importance in the ancient world and was the basis of many early calendars.[6]

The third natural timekeeper was the sun. Although it took the earth approximately 365.25 days to travel around the sun, astronomers determined the precise length of the solar year in two slightly different ways. The tropical solar year, employed by the astronomers of the Islamic tradition, was the time it took the sun, in its apparent movement, to return to the same reference point on the ecliptic – 365 days, 5 hours, 48 minutes, and 46 seconds. That reference point was typically the Vernal Equinox, where the celestial equator intersected the ecliptic (the plane of the earth's orbit around the sun). In astrological terminology it was the first point of Aries and was usually dated 21 March (although it could sometimes fall on the 19th or the 20th). The sidereal solar year, by contrast, employed in the Indic astronomical tradition, measured the apparent motion of the sun with reference to a fixed background star. The two definitions differed slightly on the length of the solar year – the sidereal being about twenty minutes longer than the tropical.

The word "calendar" comes from the Latin "calendarium," an interest register or account book. At its most basic, the calendar is a way of keeping track of the first natural time division – the day.[7] It is an abstract method of naming the days by allocating each to a week, a month, and a year. A guide to day-to-day activities, the calendar enables a society to fix its important rituals and festivals. It offers a way of recording and arranging the events of the past as well as of calculating commitments for the future. To produce such an abstract temporal system was the impetus behind most early attempts to observe and record the positions of the heavenly bodies.[8]

The Muslim day began at sundown. Although daily prayers were mentioned in the Quran, it is generally agreed that neither their number nor their timing had been established by the end of the prophet's life.

[6] Anthony Aveni, *Empires of Time: Calendar, Clocks, and Cultures* (New York: Basic Books, 1989), 86–7.
[7] *Encyclopedia Britannica*, 15th ed., s.v. "Calendar."
[8] Sir Harold Spencer Jones, "The Calendar," in C. Singer, ed., *History of Technology*, vol. 3 (London: OUP, 1957), 558.

Seventy-five to a hundred years later, however, during the eighth century, all this had changed. Five prayers had become standard but their exact time had not been specified: (1) *Salat al-maghrib* (sunset prayer), when the sun had disappeared over the horizon; (2) *Salat al-isha* (evening prayer), after twilight; (3) *Salat al-fadjr* (morning prayer), at daybreak; (4) *Salat al-zuhr* (noon prayer), after noon, the sun just beginning to decline; (5) *Salat al-asr* (afternoon prayer), the sun still high, white, and pure.[9]

The call to prayer by the muezzin (caller) was given five times a day:

> Prayer is better than sleep. God is Greatest, God is Greatest. I assert that there is no god but God. I assert that Muhammad is the Messenger of God. Come to the prayer. Come to salvation. God is Greatest, God is Greatest. There is no god but God.

Believers could begin their devotions at any time after hearing the call but, according to the law books, earlier was better.

The prayers were of unequal length – sunset had three *rakas* (bowings), evening four, daybreak two, noon four, and afternoon four. The noon prayer on Friday (the day of assembly) was special. The faithful gathered in a congregational mosque, and the usual noon prayer was shortened to two bowings. There was also a *khutba* (address). Not a Christian sermon, interpreting a passage from the sacred book, its form was fixed: Praise of God and the Prophet, a recitation from the Quran, an admonition of piety, and finally an invocation of God's blessing on the local political leader.

Because of the liturgical division of the day, Islamic astronomer/astrologers developed an early interest in the science of time keeping (*ilm al-miqat*). In the earliest centuries the times of prayer were defined by the sun: its appearance and disappearance and the length of its shadow. In the earliest astronomical handbooks (*zij*), therefore, there were extensive tables listing shadow lengths for various cities – for example, Baghdad, Cairo, and Damascus. Often as well, the handbooks included projections for nearby towns and cities.[10]

Because, however, the most important prayer of the week – the noon prayer on Friday – was scheduled for a particular moment rather than for a range of hours, an interest in more exact methods of time reckoning soon developed. By the early thirteenth century, *a muwaqqit* (timekeeper) had begun to appear on the staff of many mosques. At about the same

[9] *Encyclopaedia of Islam*, 2d. ed., s.v. "Miqat"; *Encyclopaedia of Islam*, 2d. ed., s.v. "Tarikh," 259.
[10] *Encyclopaedia of Islam*, 2d. ed., s.v. "Miqat."

time the name of another time specialist (the *miqati*), a *munajjim* who specialized in spherical astronomy and astronomical timekeeping but who was not a mosque official, became increasingly common in the astronomical/astrological literature. A man from Cairo, for example, compiled a set of tables displaying prayer times as a function of solar altitude and longitude while another put together a more comprehensive table – the time could be calculated for all latitudes from either the sun or the stars.[11]

With this commitment to more precisely dividing the day came a corresponding interest in more accurate time keeping devices. The *gnomon* (a vertical bar that casts a shadow) was the earliest instrument for telling time by the sun. But it was crude and very inaccurate and was soon replaced by the sundial. In the early thirteenth century a Cairo *miqati* wrote an extensive treatise on sundial theory and on the construction of sundials in mosques.[12] In 1276 the astronomer/astrologer Abu al-Abbas Ahmad ibn Umar al Sufi authored a treatise on the defects of sundials – their causes and correction.[13]

A further advance in the science of timekeeping was signaled by the appearance of the *clepsydras* (water clock). Invented in Babylonia and Egypt, the earliest specimen was discovered in the Temple of Karnak (fifteenth century BCE).[14] Although the sundial was unreliable, dependent on the season or the weather, the water clock enabled the *muwaqqit* to determine prayer times more exactly – without resort to astronomical tables or to the appearance of the sun or stars. The first Islamic water clocks were constructed in the early ninth century. Harun al-Rashid (r. 766–809), the legendary Abbasid ruler of Thousand-and-One-Nights fame, sent an elaborate time piece to the Holy Roman Emperor Charlemagne (r. 800–814) in 807. A sensation at the Frankish court, it was "... a marvelous mechanical contraption, in which the course of the twelve hours moved according to a water clock, with as many bronze little balls, which fell down on the hour ... there were also twelve horsemen who at the end of each hour stepped out of twelve open windows ..."[15] In 1205 CE the *munajjim* al-Rizwan completed a manuscript on astronomical clocks, with drawings illustrating their

[11] Ibid.
[12] Ibid.
[13] Abdus Sattar Siddiqi, "Construction of Clocks and Islamic Civilization," *Islamic Culture* 1 (1927): 245–51.
[14] *The International Encyclopedia of the Social Sciences*, s.v. "Time." 16:30.
[15] David Ewing Duncan, *Calendar: Humanity's Epic Struggle to Determine a True and Accurate Year* (New York: Avon Books, 1998), 117.

mechanism and functioning. He also included a description of the famous clock in the great mosque of Damascus. It had been constructed by his father, Muhammad ibn Ali ibn Rustam al-Saati (the Horologist), in the third quarter of the twelfth century.[16] By the early fifteenth century, the water clock had spread across the Islamic world and had become the instrument of choice for the *muwaqqit* and the muezzin. This interest in more accurate timekeeping was reflected in the new name of the discipline – *ilm-i muwaqqit* (science of fixed times).[17]

Unlike the day, month, or year, the week was not determined by the movements of the earth, moon, or sun. The seven-day week of the Judeo-Christian world probably derived from the Babylonian and Egyptian belief that the seven heavenly bodies ruled the days:[18] Saturn governed Saturday, the Sun Sunday, the Moon Monday, Mars Tuesday, Mercury Wednesday, Jupiter Thursday, and Venus Friday. This method of dividing the month into seven-day segments was adopted first by the Jews and later by the Christians.[19]

Although Muhammad and the early Muslims accepted the seven-day Judeo-Christian week, the problem of finding a special day of worship was difficult. According to an early tradition, the prophet stated:

> The Jews have every seventh day a day, when they get together [for prayer] and so do Christians: therefore, let us do the same.[20]

The early Muslims chose Friday (sundown Thursday until sundown Friday) as their peak day, keeping it near but separate from the holy days of the other two religions. Perhaps, however, feeling the need to further differentiate themselves, they did not make Friday a day of rest. Unlike Saturday for Jews or Sunday for Christians, Friday for Muslims was a day of ordinary activity (except for the noon prayer). To further distinguish themselves, they also settled on different names for their days. Thus, Friday, the day of the special community prayer, was the "Day of Assembly" (Yaum al-Jama) and Saturday, under Jewish influence, was the Sabbath (Yaum al-Sabt). The other days, however, were simply the

[16] Siddiqi, "Construction of Clocks," 245–51.
[17] E. S. Kennedy, "Al-Biruni on the Muslim Times of Prayer," in E. S. Kennedy, *Studies in the Islamic Exact Sciences* (Beirut: American University of Beirut, 1983), 299–310.
[18] *Encyclopedia Britannica*, 15th ed., s.v. "Calendar"; Duncan, *Calendar*, 53–55.
[19] Eviatar Zerubavel, *The Seven Day Circle: The History and Meaning of the Week* (New York: The Free Press, 1985), 14–17.
[20] Ibid., 26.

first day (Sunday), the second day (Monday), the third day (Tuesday), the fourth day (Wednesday), and the fifth day (Thursday).[21]

In the early centuries of the first millennium, the inhabitants of the Arabian Peninsula had a strictly lunar calendar. The months were defined by the phases of the moon and were approximately 29.5 days each. The lunar year, comprised of twelve lunations, was divided into two parts: four months of peace (three centered on the pilgrimage month) when raiding and fighting were prohibited, and eight months in which warfare was allowed. However, because the lunar year contained about 354 days and the solar year of four seasons about 365, the pilgrimage month, which had originally been in the autumn, regressed against the seasons, making it progressively more difficult to find provisions for traveling and animals for sacrifice. As a result, in 412 the Arabs adopted a lunisolar calendar, intercalating a month every three years, placing it between Zu al-Hijja (the month of pilgrimage) and Muharram (the first month of the year).[22]

In 631, however, according to an obscure passage in the Quran, the prophet Muhammad was commanded to reform the pagan lunisolar calendar and era that he had inherited. "The number of months in the sight of Allah is twelve – so ordained by Him the day he created the heavens and the earth.... Verily *nasi* [the intercalation of a month] is an addition to unbelief: The Unbelievers are led to wrong thereby: ..."[23] This prohibition was later repeated by the prophet: "Oh People, the unbelievers indulge in tampering with the calendar in order to make permissible that which Allah forbade, and to forbid that which Allah has made permissible. With Allah the months are twelve in number ..."[24] The Quranic verse has been difficult to interpret, the meaning of *nasi* uncertain. Some eighth- and ninth-century authorities argued that it referred to the official in charge of the calendar, while others maintained that it meant the addition of an extra month. Although most Islamic astronomers agreed with the latter interpretation, it is worth noting that in the first centuries of the present era the *nasi* was the spiritual leader of the Jewish community. He was responsible, among other things, for determining the first day of the month (on the appearance of the new

[21] Nachum Dershowitz and Edward M. Reingold, *Calendrical Calculations* (Cambridge: Cambridge University Press, 1997), 63.
[22] *Encyclopaedia of Islam*, 2d. ed., s.v. "Tarikh."
[23] Quran 9: 36–7.
[24] *Encyclopaedia of Islam*, 2d. ed., s.v. "Tarikh."

moon) and for deciding when to intercalate an extra month. By the fourth century, however, the years of intercalation had become fixed, and the *nasi* no longer made these decisions ad hoc.[25]

In the first centuries after the death of Muhammad, the beginning of the month and the number of its days varied. A new month could not be declared until the first slim crescent had appeared and predicting this event was a major motivation behind the early Muslim interest in astronomy. Soon, however, in order to simplify astronomical calculations and to establish specific dates for rituals and celebrations, Islamic astronomers adopted a schematic calendar in which the months were given a definite number of days: (1) Muharram, thirty days; (2) Safar, twenty nine days; (3) Rabi I, thirty days; (4) Rabi II, twenty nine days; (5) Jumada I, thirty days; (6) Jumada II; twenty nine days; (7) Rajab, thirty days; (8) Shaban, twenty-nine days; (9) Ramadan, thirty days; (10) Shawwal, twenty-nine days; (11) Zu al-Qada, thirty days; and (12) Zu al-Hijja, twenty-nine or thirty days. The extra day was sometimes necessary because twelve revolutions of the moon totaled about 354.25 days. In a thirty-year cycle, the additional day was added in the second, fifth, seventh, tenth, thirteenth, sixteenth, eighteenth, twenty-first, twenty-fourth, twenty-sixth, and twenty-ninth years.[26] The names of the months were pre-Islamic and did not change but they soon lost their seasonal connotations. For example, Ramadan had originally meant "hot [summer]," Safar "yellow [fall]," Rabi I "the grazing season [spring]," and Jumada I "hard, frozen [winter]." In the prophet's sermon the months were further divided: the first, seventh, eleventh, and twelfth were holy.

CEREMONIAL

The new calendar featured a number of new ceremonies. In the first years after Muhammad there were only two festivals – Id al-Fitr and Id al-Qurban. Id al-Fitr, celebrating the end of the month-long Ramadan fast, lasted for three days – from the first to the third of Shawwal. Although exceptions were made for the sick, the young, the old, and the pregnant, the expectation was that no believer would eat or drink

[25] Andre Nehr, "The View of Time in Jewish Culture," in UNESCO, *At the Crossroads of Cultures and Time* (Paris: UNESCO, 1976), 163–5.
[26] Frank Parise, ed., *The Book of Calendars* (New York: Facts on File, 1982), 71.

from sunrise to sunset. Ramadan was a month of atonement and forgiveness; during this period the gates of heaven were said to be open and the gates of hell closed.[27]

The other major feast of the Islamic year was Id al-Qurban, the Festival of Sacrifice. It occurred during the pilgrimage month (Zu al-Hijja) and ran from the tenth to the thirteenth. One of the five pillars of Islam, the pilgrimage to Mecca was an obligation which only a minority of believers could fulfill. Mecca was the birthplace of the Prophet and the home of the Kaba, the great stone that, according to tradition, had been erected by Abraham. The most important action performed by the pilgrim was the sacrifice of an animal – a chicken, sheep, goat, cow, or camel. This sacrifice, on the tenth of the month, reenacted the near-sacrifice by Abraham of Ishmael, the son of Hagar and, performed by Muslims everywhere, symbolized the solidarity of the worldwide community.[28]

A third celebration, which developed four or five centuries later, was the prophet's birthday. Because Muhammad's actual date of birth was unknown, the day of his death (12 Rabi I) was chosen as the occasion for the festivities. The celebration seems to have begun in the late twelfth century. Soon after, rulers and nobles began to mount more elaborate commemorations, which came to include recitations from the Quran as well as stories from the prophet's life – in verse or in a combination of verse and prose.[29]

The festival of Ashura, celebrated during the first ten days of Muharram, commemorated the death of the Imam Husain (son of Ali and grandson of the prophet) at Kerbala on 10 October 680. During the first nine days the celebrants donned mourning clothes, ate simply, and listened to stories of Husain's sufferings. Groups of half-naked men paraded through the streets flagellating themselves, crying, and moaning. On the tenth day, a replica of Husain's coffin was publicly displayed and his funeral was reenacted. Although the ritual was most popular in Shiite communities, the tale of Husain's passion and death had the power to touch the lives of Muslims of whatever persuasion.[30]

[27] G. E. von Grunebaum, *Muhammadan Festivals* (New York: Henry Schuman, 1951), 51–3, 56–65.
[28] Ibid., 15–36.
[29] Ibid., 73–7.
[30] Ibid., 85–9.

CHRONOLOGICAL

From the chronological perspective the study of time is the study of the year. In order to locate significant religious, cultural, and political events many early states organized their years into eras. An era was a numbered collection of years reckoned from a specific date. The founding date, known as the epoch, typically marked an important event: the founding of a dynasty or the birth of a prophet or king. By introducing eras, societies were able to traverse time in two directions – earlier events could be related one to the other, sooner or later, and future events could be predicted and located with accuracy.[31]

During the decade and a half following the Prophet Muhammad's migration (*hijra*) from Mecca to Medina his followers gave the years names rather than numbers. The second was the Year of Permission, the fifth was Congratulations on Marriage, and the year of his death was Farewell. However, Umar (634–44), the second caliph, soon realized that in his rapidly expanding community a more conventional chronology was needed. Thus in 638 he established the Hijra Era. The departure of Muhammad from Mecca in 622 was chosen as the starting point because, according to tradition, the prophet's followers could not agree on the date of his birth. The inaugural day of the new era, however, was not the actual date of the prophet's emigration but was rather the first day of the lunar year in which it took place. Thus, 1 Muharram AH 1 was 16 July 622. The first documented example of the new era was an Egyptian papyrus of 22 AH (642–43 CE).[32]

Munajjim (Astronomer/Astrologer)

In medieval and early modern Islam time was defined by the movements of the seven heavenly bodies – sun, moon, Mercury, Mars, Venus, Jupiter, and Saturn. And as it was the responsibility of the *munajjim* to chart and interpret their movements, he became the time specialist, the man in charge of the Islamic temporal system in all its phases – calendrical, ceremonial, and chronological. According to the early encyclopedist, Jabbir b. Hayyan, the *munajjim* "... must have a mastery of astronomy ... [which is] a

[31] Paul Ricoeur, *Time and Narrative*, trans. Kathleen Blamey and David Pellauer (Chicago: University of Chicago Press, 1988), 71–2.
[32] E. G. Richards, *Mapping Time: The Calendar and Its History* (Oxford: Oxford University Press, 1999), 234.