One can easily observe two types of periodic behaviour of the sun:

1. a *long solar cycle*: the year, recognised by the seasons, equinoxes and solstices;
2. a *short solar cycle*: the day, marked by sunrise, noon and sunset.

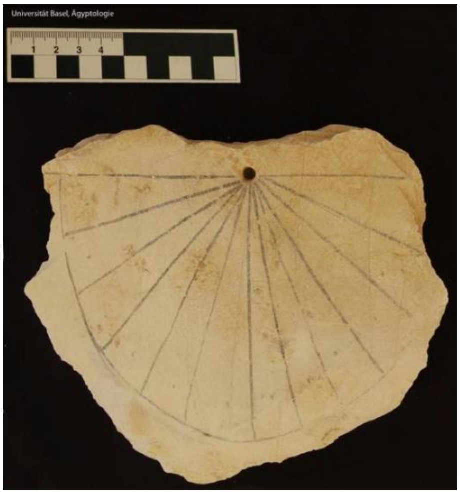
Of course the night is similar to the day, but then the sun is "nowhere" and it seems ancient people hardly understood how it spent the night. Moreover, the invisible nighttime sun is useless for measurements. Of course they did know the night was on average as long as the day.

This *long solar cycle* is of course determined by Earth's orbit around the sun. As seen from Earth, the sun seems to traverse the firmament every year and its apparent path between the stars is called the *ecliptic*. There is nothing wrong with a geocentric perspective, it is just not the most elegant way to describe the solar system.

It happens to be that the moon follows nearly the same path whilst cycling around the earth, because it orbits in nearly the same plane as the earth around the sun. In one year, the moon orbits Earth 12.37 times, which rounds to 12. After each lunar orbit the sun has travelled roughly $1/12$ of its apparent annual journey along the *ecliptic*, so the moon divides the *ecliptic* into 12 equal parts.

Obviously, this number 12 is a purely coincidental value of cosmological origin, but Homo Sapiens seems to have assigned it a special meaning. He divided the *ecliptic* into 12 constellations: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius and Pisces. Yes, the *zodiac signs*. Yours is the one that was right behind the sun (from Earth's perspective) when you were born.

> The moon divides the *long solar cycle* into 12 equal parts which we call *months* (moons);
> Homo Sapiens divided the *short solar cycle* into 12 equal parts which we call *hours*.



The oldest known sundial, found in the Valley of the Kings[1], already divided the day into 12 hours.

A sundial that is on a south facing east-west wall casts a rather vague shadow during the first & last hour of the day. You can *count on your fingers* that this leaves 10 practicable hours per day.

Now take 7 identical smooth-edged round coins. You can easily find out that 6 of them exactly fit around the 7th. So a circle fits exactly 6 times around itself, hence it divides itself into 6 equal *segments*. One could call 6 the *circle number*.

Now it happens to be that $12 = 6 + 6$. As seen from Earth, both the sun and the moon orbit us, yielding 2 apparent circles of 6 *segments* each, which makes 12.

The number 360 is a special number. It has 24 divisors, including 1 and itself: $[1,2,3,4,5,6,8,9,10,12,15,18,20,24,30,36,40,45,60,72,90,120,180,360]$. This is a GREAT number of divisors and 360 happens to be the smallest number that has so many. Most other not too large numbers do not come near it. This makes 360 very suitable for doing calculations. Homo Sapiens divided the circle into 360 *parts*. Each of the circle's 6 *segments* consists of $360/6 = 60$ *parts*. 60 is also a special number, it is the smallest number with 12 divisors: $[1,2,3,4,5,6,10,12,15,20,30,60]$. And $360 = 6 \times 6 \times 10$, the *circle number* squared times our finger count.

Another cosmological coincidence is that there are roughly 365 days in a year, which quite accurately approximates 360. So the *long solar cycle* lasts $365 \approx 360$ *short ones*, and the daily advance of the sun along the *ecliptic* nearly exactly equals 1 *part* of a circle, so one can say a *short solar cycle* corresponds to 1 *part*.

A day + night make a full circle, hence the *short solar cycle* (from sunrise to sunset) consists of 180 *parts*. This means that during the day, the sun advances by $180/12 = 15$ *parts* per hour.

As said, the moon orbits the earth 12 times a year, so a month lasts 30 *short solar cycles* (coincidentally, $30 = 5$ [fingers on one hand] $\times\ 6$ [the circle number]), yielding a daily advance of the moon by $360/30 = 12$ *parts*. Now consider the first visible crescent after it has been new moon (originally, *that* was the new moon) just after sunset. Moonset will be a bit later than sunset and the

[1] https://en.wikipedia.org/wiki/History_of_sundials

intermediate time span is called the *moonshine duration*. Next day the moon has advanced by 12 *parts* (away from the sun) which relates to the hour as $12/15 = 4/5$. Hence the *moonshine duration* grows with $4/5$ of an hour each day. In the second half of the month, past full moon, the *moonshine duration* is the time between moonrise and sunrise, which then has a daily decline of $4/5$ of an hour. So every day the *moonshine duration* changes by $4/5$ of an hour, hence the moon divides the hour into fifths and a fifth of an hour is called a *point*[2].

A day has 12 hours and there are 5 *points* per hour. That makes 60 *points* per day. A day also corresponds to 1 *part* of a circle, hence the moon divides the *parts* of a circle into 60 *small parts*, which is the 2nd appearance of the number 60. It also was the number of *parts* per circle *segment*, remember? But now it is a subdivision of the *parts*. So the circle consists of 360 *parts* and it divides itself into 6 *segments* of 60 *parts* each, and each *part* is divided into 60 *small parts* by the moon.

In the 2nd century CE, *Κλαύδιος Πτολεμαῖος* (*Klaúdios Ptolemaîos = Claudius Ptolemaeus = Ptolemy*) wrote a work named *Μαθηματικὴ Σύνταξις* (*Mathēmatikē Syntaxis = Scientific Treatise*). This was later called *Ἡ Μεγάλη Σύνταξις* (*Hē Megalē Syntaxis = The Great Treatise*). The superlative of *Μεγάλη* (*Megalē = Great*) is *Μεγίστη* (*Megístē = Greatest*). In Arabic this became المجسطي = *al-majisṭī*, which in the 12th century was Latinised to *Almagestum* by *Gerardus Cremonensis*. Nowadays it is called the *Almagest*. In it, *Ptolemy* divides the circle into 360 *parts* and he uses the sexagesimal system for their subdivision. That is, each *part* is divided into 60 *small parts* (Latin: *Pars Minuta = Small Part*), which are divided once again into 60 even *smaller parts* (Latin: *Pars Minuta Secunda = Next Small Part*). Nowadays we call the *part* and its fractions a *degree*, a *minute of arc*, and a *second of arc*.

Please note this is about angles. But in the late middle ages mechanical clocks appeared, with just one hand, indicating the 12 hours. Once *Christiaan Huygens* had invented the pendulum clock another hand was added which did a full revolution in 1 hour, passing each of the 12 hour marks. And although I have - as yet - never found an image of an original medieval one-hand clock with its hours divided into 5 *points* (which would be suitable for measuring the *duration of the moonshine*), this extra hand's full circle does consist of $12 \times 5 = 60$ *points*, which then divides the hour into 60 *small parts*. It turned the *Pars Minuta* (which already indicated $1/60$) into a unit of time. When clocks became even more accurate, they got yet another hand, dividing it into 60 once again, turning the *Pars Minuta Secunda* into a unit of time as well. It enabled all 19th century vest pocket watches to show an exactly different time, where everyone's own watch of course was the only correct one. So obviously, the third hand is the second hand, the second hand is the minute hand, and the minute hand is the hour hand (but originally, the minute hand was the minute hand) 😛.

The underlying coincidental cosmological facts are Earth's axial rotation and her orbit around the sun, yielding the so-called *tropical year* of 365.2422 days (365d+05:48) ≈ 360, resulting in 1 *part* = *degree* per day, and the *synodic month* of 29.5306 days (29d+12:44) $\approx 30 = 360/12$, yielding 12 months per year, 12 zodiac signs, 12 hours per day and 5 *points* per hour = 60 *points* per day = 60 *small parts* per *part* = minutes of arc.

Mathemagical facts are the circle dividing itself into 6 *segments*, $360 = 6 \times 60 = 6 \times 6 \times 10$, and 360 having 24 divisors. Hmm, that equals $12 + 12$. Sed hypotheſes non fingo.

And now this: the firmament contains a number of heavenly celestial objects upwards in the sky above our heads whose positions continuously vary relative to all others. These others are called the *fixed stars* and the ancient Greeks called the ones with varying positions: *πλανήτης* (*planḗtēs = wanderer*). Yes, they are the planets! The classical planets, that is. With the naked eye, i.e. without a telescope or so, you can see: the sun, the moon, Mercury (if you're lucky), Venus, Mars, Jupiter, and Saturn. Yes, to the ancient Greeks the sun and the moon were planets as well. They do not have fixed positions. Please count these classical planets, as well as the number of days in a week.

In 1987, the

[2] https://www.dbnl.org/tekst/gumb002comp01_01/ Marijke Gumbert-Hepp, Computus Magistri Jacobi, dissertation (1987) in Dutch containing original texts in Latin (she translated punctum to *stip* in Dutch, but *punt* is closer to the original).

In 1987, the Dutch historian Marijke Gumbert-Hepp wrote her thesis about the Computus Magistri Jacobi[3] (*Computus by Master Jacob*), which is a medieval school book from 1436 CE. It contains next:

> In ista tabula ostenditur qua hora quilibet planetarum regnat, unde, sicut septem sunt dies in septimana, sic septem sunt planete in quolibet die regnantes et ista inferiores regentes, inter quos tamen unus est predominans in quolibet die suo ordine. Nam quilibet (lege cuilibet) septem dierum deputatum est suus planeta predominans qui incipit suum regimen in prima hora talis diei incipiendo diem a medio noctis. Et alii planete presunt aliis horis secundum illum ordinem secundum quem stant orbes planetarum. Unde ordo planetarum talis est ut Saturnus sit primus, Iupiter secundus, Mars tercius, Sol quartus, Venus quintus, Mercurius sextus, et luna septimus.
>
> *In this table is shown at which hour each of the planets reigns, and just as there are seven days in a week, there are seven planets, among whom, although all of them reign every day and perform the lower ruling as well, one of them dominates on turn. For each (read to any) of the esteemed seven days its predominant planet is the planet that rules the first hour of the day, starting at midnight. The other planets rule the successive hours in the order how their orbits are. Therefore the plantary order is: Saturn be the first, Jupiter second, Mars third, Sun fourth, Venus fifth, Mercury sixth, and the moon seventh.* [table layout by HR].

Numerus Horarum:	**1**	2	3	4	5	6	7	**8**	9	10	11	12	...	19	20	21	22	23	24
Dies Solis:	**Sol**	Ven	Mer	Lun	***Sat***	Jup	Mar	**Sol**	Ven	Mer	Lun	***Sat***	...	***Sat***	Jup	Mar	Sol	Ven	Mer
Dies Lune:	**Lun**	*Sat*	Jup	Mar	Sol	Ven	Mer	**Lun**	*Sat*	Jup	Mar	Sol	...	Sol	Ven	Mer	Lun	*Sat*	Jup
Dies Martis:	**Mar**	Sol	Ven	Mer	Lun	*Sat*	Jup	**Mar**	Sol	Ven	Mer	Lun	...	Lun	*Sat*	Jup	Mar	Sol	Ven
Dies Mercuriis:	**Mer**	Lun	*Sat*	Jup	Mar	Sol	Ven	**Mer**	Lun	*Sat*	Jup	Mar	...	Mar	Sol	Ven	Mer	Lun	*Sat*
Dies Iovis:	**Jup**	Mar	Sol	Ven	Mer	Lun	*Sat*	**Jup**	Mar	Sol	Ven	Mer	...	Mer	Lun	*Sat*	Jup	Mar	Sol
Dies Veneris:	**Ven**	Mer	Lun	*Sat*	Jup	Mar	Sol	**Ven**	Mer	Lun	*Sat*	Jup	...	Jup	Mar	Sol	Ven	Mer	Lun
Dies Saturni:	***Sat***	Jup	Mar	Sol	Ven	Mer	Lun	***Sat***	Jup	Mar	Sol	Ven	...	Ven	Mer	Lun	*Sat*	Jup	Mar

Read the table line by line to recognise the hourly order of the planets by descending orbital periods: *Sat*: 29.5 y, Jup: 11.9 y, Mar: 1.9 y, Sun: 1 y, Ven: 225 d = 0.6 y, Mer: 88 d = 0.2 y, Lun: 30 d = 0.08 y. Yes, as seen from Earth, the sun orbits *us* once a year! Then read the column of the first hour of each day. And although *Saturn be the first* planet in the order of their orbits, the first day of the week is Sunday. Please note: the 8th hour has the same ruling planet & it starts at 7 AM = one hour after sunrise, the effective start of the day. But according to ISO 8601:2004(E), Monday is the first day of the week. After all, Sunday is part of the week<u>end</u>, isn't it? See next list of days of the week in various languages (as well as in that weird collection of silly sounds they call English ☺).

Latin	Italian	French	Spanish	Rumanian	Portuguese	Hebrew	English	Germanic deity
Dies Solis	domenica	dimanche	domingo	duminica	domingo	1st day	Sunday	
Dies Lunæ	lunedi	lundi	lunes	luni	segunda feira	2nd day	Monday	
Dies Martis	martedi	mardi	martes	marti	terça feira	3rd day	Tuesday	Tiwaz (*war*)
Dies Mercurii	mercoledi	mercredi	miércoles	miercuri	quarta feira	4th day	Wednesday	Wodan (*frenzy*)
Dies Iovis	giovedi	jeudi	jueves	joi	quinta feira	5th day	Thursday	Thor (*thunder*)
Dies Veneris	venerdi	vendredi	viernes	vineri	sexta feira	6th day	Friday	Frigg (*love*)
Dies Saturni	<u>sa</u>bato	samedi	sábado	sambata	sábado	Sabbath	Saturday	

Please lookup the Roman deities yourself and compare their "specialties" to those of their Germanic "cousins". And note: the Italian/French/Spanish/Rumanian/Portuguese words for Sunday have nothing to do with the sun, but with Latin Dominus = Lord, so it means *day of the Lord*. The jews obviously do not celebrate the Christian Lord, they celebrate G-d on the Sabbath. The Portuguese use practically the same day names as the jews, but they included the day of the Lord.

To my knowledge there has never ever been a "hiccough" in the succession of the days of the week as far as can be determined by historical evidence. And for the Dutch reader: nou weet je eindelijk ook eens wat een "zater" is: ***zater**dag* = ***saturn**usdag*. And Venus, the goddess of ♡, the brightest in the sky after ☼ & ☾, is (alternately) either the morning star or the evening star. Each lasts 9 months.

[3] https://www.dbnl.org/tekst/gumb002comp01_01/ (in Dutch)

