CHAPTER 2

GENERAL DESCRIPTION OF THE CHINESE CALENDAR

Limitation and Scope

This chapter addresses the question of the Chinese official calendar from the perspective of its surface structure. It will thus be temporarily regarded as a discrete architecture, made up of particular sequences of days, essentially grouped into solar or lunar months and solar or lunar years.

For the sake of simplicity, it will also be described in a most systematic and simplified way as possible, in order to highlight its most prominent and invariant aspects from 104 BC to AD 1644. Nonetheless, examples of anomalous years and other striking but local peculiarities, not liable to modify significantly its overall picture, will also be taken into account.

In the same spirit, the presentation of the prolific terminology of the Chinese surface calendar[1] will be limited to the essentials because an immersion into endless philological details would perhaps have been detrimental to the perception of its overall pattern: the purpose of this study is not the writing of a dictionary but only the description of a not so obvious structure. Yet, some salient points of interest in this respect will be taken into account and new translations of key terms will be propounded when appropriate.

[1] Overall, this point has been adequately dealt with by Havret and Chambeau 1920.

J.-C. Martzloff, *Astronomy and Calendars – The Other Chinese Mathematics*, DOI 10.1007/978-3-662-49718-0_2

The Fundamental Components of the Chinese Calendar

The Day

The most fundamental unit of time of the Chinese calendar is the nychtemeron, or a day plus a night. More simply, it will be referred to as ‘the day’ in the following. In Chinese sources, its name is *ri* 日 (literally ‘the sun’) even if its apparent meaning excludes the idea of night. This appellation is naturally as vague as those attested in Western languages but what is intended in such and such a case is generally sufficiently explicit from the context.

Calendars from various periods define the beginning and end of the day in various ways. During our period of study, the Chinese day extends from any instant of midnight to the next.[2]

For obvious reasons, the day is generally the smallest unit of time of Chinese surface calendars but smaller units also appear occasionally. Some calendars, from the Tang and later periods, record the calculated occurrence of certain phenomenon such as the instants of sunrise or sunset, the lengths of day and night and the like. In such a case, however, as already noted above, p. 30, only a system of time units peculiar to the surface calendar is used.[3]

These calculated instants are thus expressed with systems of units completely different from those used in the deep structure and, in particular the precision they allow is not identical in both cases. Nevertheless, the two structures are not independent from each other and the existence of different systems of units of time in each case imply the existence of techniques of conversion.

The Solar Year

The solar year of the Chinese calendar is often called *nian* 年 or *sui* 歲 and these two terms already occur in oracular inscriptions on tortoise shells and bones of animals (*jiaguwen* 甲骨文).[4] The first term

[2] For earlier periods, the calendrical day has not always been defined in such a way. For instance, as explained by L. Vandermeersch 1980, p. 319, in the Shang-Yin sexagenary calendar the day extends from one sunrise to the next.

[3] For a specific example (Ming dynasty), see p. 215 below. More generally, see also Chen Jiujin 1983; Chen Zungui 1984, p. 1343–1348.

[4] L. Vandermeersch 1980, ibid., p. 326.

means at the same time ‘crop’, ‘harvest’ or ‘crop year’, in relation to the two successive crops of a year, the first concerning millet and the second wheat. The second term refers to the twelfth part of the sidereal revolution of Jupiter – ‘the Year Star’ (*suixing* 歲星) –, a duration approximately equal to one solar year (*sui* 歲).

In the surface calendar, the solar year is defined as equal to the integer number of days between two calculated consecutive winter solstices. Hence its length, 365 or 366 days. Moreover, from 104 BC to AD 1644, the beginning of the Chinese solar year falls between December 25 and December 21 in the Julian or Gregorian calendar, as the case may be.

The Twenty-Four Solar Breaths

The division of the length of the solar year by 24 gives rise to as many intervals of equal lengths in the calendrical deep structure and unequal lengths in the surface structure (15 or 16 days).[5] The 24 particular days of the surface calendar determined by the beginnings of these intervals are denoted here by $q_1, q_2, \ldots, q_{24}$.[6] They represent the ‘breaths’[7] of the solar year, *qi* 氣, with reference to the dynamic and vital energy principle, manifesting itself through the fluctuations of the *yin* and *yang*.[8] Moreover, in accordance with a well-established practice, we still call a ‘solar period’ any interval extending between two consecutive solar

[5]These numbers of days are only valid from 104 BC to AD 1644. After 1644, the Jesuit astronomers responsible for the reform of Chinese astronomy have substantially modified Chinese calendrical calculations by linking the Chinese solar year to the true motion of the sun instead of merely dividing it into 24 equal time-intervals. Hence variable intervals, possibly composed of 14, 15 or 16 days each, from 1645 onwards (the year 1644 still uses the Ming astronomical canon, the *Datong li* 大統曆).

[6]The same notation is also used hereafter with respect to the corresponding deep structure, in which case the q_i are determined instants of time.

[7]This rendering appears first in D. Bodde’s English translation of Feng Yu-lan’s *History of Chinese Philosophy* (Fung Yu-lan 1952–1953, vol. 2, p. 114). Some other translations, sometimes independent of philology and of the Chinese cultural context, such as ‘solar terms’, are also widely used.

[8]L. Vandermeersch 1980, p. 329, remarks that the Chinese calendarists identified the year with a vast respiration, as soon as they became aware of its existence and that they gave it the dynamic structure of a breath, organized in inspirations and exhalations. On the notion of *qi* 氣 and its multiple renderings (air, vapor, stream, vital force, ether, material force, energy, etc.), see S. Onozawa, M. Fukunaga and Y. Yamanoi 1978/1984*’s illuminating study.

breaths. Four breaths mark the two solstices and the two equinoxes, i.e. the winter solstice, *dongzhi* 冬至 (literally. The culmination of winter), the Summer Solstice, *xiazhi* 夏至 (the culmination of summer), the Spring Equinox, *chunfen* 春分 and the Autumn Equinox, *qiufen* 秋分. Four other breaths, distinct from solstices and equinoxes, indicate the beginnings of the four seasons and are called 'Enthronement of Winter', *lidong* 立冬, 'Enthronement of Spring', *lichun* 立春, 'Enthronement of Summer', *lixia* 立夏 and 'Enthronement of Autumn', *liqiu* 立秋. They are collectively referred to as the 'Four Enthronements', *si li* 四立. Taken together, the two Solstices, the two Equinoxes and the 'Four Enthronements' are called 'the Eight Nodes', *bajie* 八節.[9] Moreover, the quadripartition of the solar year into four intervals, in two different ways by means of its solstices and equinoxes on the one hand and its Four Enthronements on the other hand, determines two sorts of seasons:

- the four usual astronomical seasons, determined by the calendrical solstices and equinoxes;

- the four civil seasons determined by the 'Four Enthronements'.

Consequently, the beginning of the winter season, with respect to the second quadripartition of the solar year, does not start from the winter solstice but from an instant located one month and a half earlier, between November 9 and 6, always between 104 BC and AD 1644. Similarly, Spring 'starts in winter' if we may say so, always one month and a half earlier than the Spring Equinox and the same holds true for the two other seasons. The Chinese calendar shares this peculiar organization of its seasons with other calendars, such as the Zoroastrian calendar *gāhānbār*[10] and with the Celtic calendar, from the British Isles and elsewhere in Europe. That is why the terms *midsummer* and *mid-somer* both refer, in modern and middle English, to the night closest to the summer solstice (*mid-somer night*). In this way, summer begins one month and a half earlier than the astronomical summer, starting from the summer solstice. This is precisely what the playwright Shakespeare refers to in his tragedy *A Midsummer Night's Dream*, a title generally reduced to

[9] DKW, 2-1095, 1450:310.
[10] A. Panaino 1990.

'*Le songe d'une nuit d'été*' (*A Summer Night's Dream*) in French translation. Likewise, the term *midwinter* is also an appellation of the winter solstice whereas *mid-autumn* and *mid-spring* have similar meanings.[11]

Apart from the eight breaths determining the beginnings of the two sorts of seasons of the Chinese calendar, astronomical and civil, five other breaths mark the periods of heat and cold and seven other announce various aspects of atmospheric precipitations or humidity. Lastly, one of the four remaining breaths, *qingming* 清明 (Pure Brightness), occurs towards the beginning of April and evokes the clarity of the atmosphere while the three others evoke various natural transformations linked with agricultural activities: *jingzhe* 驚蟄 (Waking of Insects), between March 7 and 11, *xiaoman* 小滿 (Grain Full), between May 22 and 27, and *mangzhong* 芒種 (Bearded Grain), between June 6 and 10.[12]

With respect to our period of study, the complete list of the 24 solar breaths first appears in the astronomical canon of the *Hanshu*[13] due to Liu Xin 劉歆 (32 BC ? – 23).[14] Their order of enunciation, however, is not wholly identical with the one generally followed during the greater part of Chinese history and still now. The breaths q_5–q_6, on the one hand and q_8–q_9, on the other hand, are interchanged.[15] Likewise, the *Wuyin li* 戊寅曆 (Fifteenth-Year Epoch canon), from the beginning of

[11] See H. Kurath et al. 1975 and the interesting remarks of the archaeoastronomer E.C. Krupp 1994, p. 195: "The Celtic New Year took place in early November [...]. This falls about midway between the autumnal equinox and the winter solstice and was traditionally the start of winter in the British Isles". The same author also notes that this kind of winter beginning coincides with Halloween. Lastly, always along the same lines, the ethnologist D. Laurent has also proven – from a very particular question of Breton ethnology, viz a ritual of circumambulation (penitential long march following a path in the form of a quadrilateral twelve kilometers long through the countryside, starting from and arriving at the tomb of Saint Ronan, Irish bishop from the High Middle Ages) – that the Breton calendar also follows the same quadripartition of the solar year. See D. Laurent 1990.

[12] See Appendix B, p. 343.

[13] *Hanshu*, *j.* 21B, 'lüli zhi 2', p. 1005-1006.

[14] On Liu Xin, see H. Kawahara 1989; C. Cullen 1996 and 2004, p. 31 and p. 27, respectively.

[15] C. Cullen 1996, ibid., p. 108.

the Tang dynasty,[16] rely on a list where q_5 and q_6 are inverted.[17] These exceptions were temporary, however, and their most frequent order of enunciation[18] is the same as the one already adopted in the *Huainan zi* 淮南子[19] (second century BC), a treatise more ancient than the *Hanshu* and the *Zhoubi suanjing*[20] 周髀算經. Irrespective of their order of enunciation, the solar breaths can in no way apply stricto sensu to the whole of China as climatic benchmarks, given the extent of its territory. Only the basin of the Yellow river or slightly more northern regions would be adequate in this respect.[21] Certain Southern regions do not get snowfalls while other lands are used for rice-growing instead of cereals. In fact, the Chinese official calendar remained identical everywhere until 1644. Initially restricted to a meteorological and agricultural particular situation, the solar breaths of the Chinese calendar were thus used everywhere alike in the Chinese world, even in regions having quite different characteristics.

The Seventy-Two Seasonal Indicators

A refinement of the notion of solar breaths leads to a finer subdivision of the solar year into 72 seasonal indicators *qishi'er hou* 七十二候.[22]

Like the solar breaths, the seasonal indicators are associated with 72 particular days of the surface calendar and the interval of time between two consecutive indicators contains most often 5 days, and sometimes one more day, 5 or 6 times within a same solar year.

---

[16] *Wuyin* 戊寅 is the fifteenth sexagenary binomial. Concerning here the enumeration of lunar years, it represents the year 618, the epoch of the *Wuyin li* 戊寅曆, the first year computed with its procedures being the year 619. See LIFA, p. 458.

[17] *Xin Tangshu*, *j.* 25, 'li 1', p. 539.

[18] See Appendix B, p. 343 below.

[19] See Ch. Le Blanc and R. Mathieu 2003, p. 115 f. On the history of the 24 solar breaths before the Han dynasty, see also J.S. Major 1993, p. 90 f., Chen Zungui 1984, p. 1376–1380.

[20] C. Cullen 1996, p. 108.

[21] See J. Needham 1959, p. 405: "The names of the periods [i.e. the 24 solar periods delimited by consecutive solar breaths] suggest that the list was first established in, or north of, the Yellow River valley".

[22] *Hou* 候 means 'state', 'symptomatic moment' (of a disease), 'time when something happens', notably.

Although the 72 seasonal indicators are already mentioned very early in a chapter of the *Liji* 禮記 [23] (*The Ritual*), one of the Confucian classics, they are believed to have been first incorporated into the calendar many centuries later, at the earliest, during the Northern Wei dynasty (386–534),[24] but no authentic calendar from this period mentioning them has reached us. Moreover, their appellations have known a number of variants, which have been fixed once and for all after the carving of the *Liji* 禮記 and other Confucian classics on steles in 837.[25]

Rather differently from the 24 solar breaths, each seasonal indicator bears a name relating to a series of real of fictitious natural phenomena, reflecting an archaic Chinese conception, inclined to put on an equal footing meteorological, agricultural or zoological natural phenomena, together with fantastic interpretations of climatic changes occurring during a year.

For instance, certain seasonal indicators refer to the melting of the ice, the rumble of thunder, the growth of buds, the thawing of source water, the flowering of peach trees, the arrival of the martins, the fall of dear antlers and other common natural events. By contrast, other indicators signal the quasi-Ovidian metamorphosis of eagles into turtle doves, of moles into quails, of sparrows into shells or of birds into oysters, after their dives into the sea. Lastly, the spontaneous generation is also present through the generation of fireflies from rotten grass.[26]

The 72 days of the calendar associated with a seasonal indicator are not determined independently of the 24 solar breaths. On the contrary, they form a finer subdivision of the solar year, coinciding partly with them, since 24 different seasonal indicators fall exactly on the same day as a solar breath.

When a coincidence between a solar breath and a seasonal indicator exists, the latter is called an 'initial indicator', *chu hou* 初候, while the two next ones are respectively called the 'following indicator', *ci hou* 次候, and 'final indicator', *mo hou* 末候.[27] Naturally, this final indicator is also the Initial Indicator of the next solar breath.

---

[23] See *Liji*, 'Yueling', *in* S. Couvreur 1950a, t. 1, 1st part., p. 390–410.
[24] See *Weishu*, *j.* 107A and 107B, 'lüli zhi 3a–3b', p. 2679–2681 and p. 2716–2718.
[25] A. Arrault 2003, p. 102.
[26] See Appendix C.
[27] Ibid.

The tripartition of each solar period resulting from this arrangement produces 3 smaller periods having a variable number of days. Depending on whether the solar period in question is composed of 14, 15 or 16 days, their respective numbers of days are equal to 5, 4, and 5 days, 5, 5 and 5 days or 6, 5 and 5 days, not necessarily in this order.

The Five Phases

The five phases, *wu xing* 五行 (*jin* 金 Metal, *mu* 木 Wood, *huo* 火 Fire, *tu* 土 Earth and *shui* 水 Water), are key cosmological categories supposed to rule over (*wang* 王) portions of the solar year each in their turn, on the basis of its partition into five connected or disconnected sets of days, composed of approximately 73 days ($73 \times 5 = 365$)[28] each.

In a highly original way, four of these shortened seasons, or pseudo-seasons, form a single block whereas the fifth one, corresponding to the period of governance of the Earth, *tuwang* 土王, consists of four disjoint intervals, having altogether the same length as each of the four other pseudo-seasons.

The first day of the four pseudo-seasons is always one of the 'Four Enthronements' of ordinary civil seasons (*si li* 四立 , i.e. Enthronement of Spring, Summer, Autumn, Winter) recording 73 days each, approximately. By contrast, the Earth 'season' is made up of four disjoint intervals, generally having 18 days each, and extending from the day following the last day of one of the four pseudo-seasons to the next Enthronement.

With this pattern, the Earth phase is seen as ensuring a balanced transition between the four seasons, whereas Water, Fire, Wood and Metal respectively govern winter, summer, spring and autumn.

In practice, calendars signal this quinary division of the solar year by merely inserting the two characters *tuwang* 土王 above each column of text marking their initial days, other indications being superfluous since the Enthronements of the pseudo-seasons always coincide with already known elements of the calendar.

[28] *Weishu*, *j.* 107A, 'lüli zhi 3a', p. 2677 (most ancient reference to this topic).

The Lunar Year

Depending on its ordinary or intercalary character, the Chinese lunar year is composed of 12 or 13 lunar months. The time span composed of 12 lunar months is conventionally called ‘a lunar year’ but this appellation does not refer to any astronomical lunar cycle, the term year being used analogically, with reference to the solar year, 12 lunar months being approximately 11 days less than a solar year of 365 days while 13 lunar months have 19 more days.

More exactly, apart from exceptional cases listed at the end of the present chapter, an ordinary Chinese lunar year is composed of 353, 354 or 355 days, or from 10 to 13 fewer days than a solar year whereas an intercalary lunar year has either 383, 384 or even 385 days, as the case may be.

Lunar Months, Ordinary and Intercalary

The lunar months of the Chinese calendar are obtained from calculated new moons and are represented by the character *yue*, 月, derived from a pictogram of the moon. They begin on the day where the calculated new moon, *shuo* 朔, falls and extend to the day preceding the following new moon, marking the beginning of the next lunar month.

The first month of the lunar year is called *zhengyue* 正月, an appellation intended to draw the attention to the fact that its position with respect to the solar component of the calendar is not fixed once and for all but changes with respect to some official lunisolar norm *zheng* (正) (see p. 76 below). In other words, the first month of the Chinese calendar is not merely a first month but also a distinguished month, having a particular position marking the kind of lunisolar norm chosen in order to establish a connection between the solar year and the beginning of the lunar year.

By contrast, the names of the other ordinary months are regularly numbered from two to twelve. From the second to the twelfth, the successive lunar months are thus respectively named *eryue* 二月; (second month), *sanyue* 三月; (third month) and so on, up to *shi'eryue* 十二月 (twelfth month).

When a lunar year is intercalary, the number of lunar months becomes equal to 13 but non-intercalary lunar months are still numbered as if the lunar year were ordinary and its intercalary month is inserted between two ordinary lunar months. The first of these is then called *i-yue* and the second $(i+1)$-*yue* but never $(i+2)$-*yue*. In its turn, the intercalary month, is called *run i yue* 閏 *i* 月 (*run* = intercalary). Of course, its true arithmetical rank is $i+1$. Consequently, we will use the notation i, $i*$, $i+1$, ... where $i*$ is the intercalary month. However, the temporary notation i, $i+1$, $i+2$ will be maintained as long as its position will not have been established, even when the lunar year is known to have 13 months, because the rank of an intercalary month cannot be determined from the surface calendar alone but only from more or less complex calculations depending on its deep structure.

The position of an intercalary month is not fixed once for all; it can occur absolutely anywhere, at the beginning, middle or end of the lunar year. There is an exception, however, but it does not concern calendars issued between 104 BC and AD 1644. In high antiquity, it was probably systematically placed after the twelfth month, at the very end of the lunar year. During the Qin dynasty, from 221 to 206 BC, it was placed after the ninth month. Hence its name *hou jiuyue* 後九月 (posterior ninth month).[29]

Ordinary and intercalary months can be full or hollow and the number of days of an intercalary month, $i*$, is not connected in any way with the hollow or full characters of the months i and $i+1$.

Full and hollow months are respectively called *da* 大 'long' and *xiao* 小 'short'.

Within a lunar month, three particular days are associated with moon phases other than a new moon: the first quarter *shangxian* 上弦, the full moon *wang* 望, and the last quarter *xia xian* 下弦. The number of days between these different phases of the moon is variable and equal to 6, 7 or even 8 days.

The Structure of the Lunar Year

The possible numbers of days of an ordinary or intercalary lunar year, already indicated above, p. 69, can be obtained from various positive integers x and y of full (30 days) and hollow months (29 days), both smaller than 12 or 13 and such that:

[29] Chen Zungui 1984, p. 1383 and p. 1422–1423.

$$30x + 29y = 353, 354, 355, 383, 384 \text{ or } 385 \text{ days.} \tag{2.1}$$

As can be readily checked, each of these six equations has a unique solution (x, y). For example, lunar years of 353 days can only be obtained from the pair of full and hollow months $(5, 7)$ and in no other way. Likewise, the other sorts of lunar years, composed of 354, 355, 383, 384 and 385 days, correspond to the solutions $(6, 6)$, $(7, 5)$, $(6, 7)$, $(7, 6)$ or $(8, 5)$, respectively. The relative proportion of these various sorts of years is quite variable however. Without going into the details, years of 353 or 385 days are extremely rare. The years Zaichu 2 (690) and Chongzhen 15 (1642) are examples of each.

The Percentage of Full and Hollow Months

Given that the mean value of the lunar month is approximately equal to 29.53 days, two mean lunar months are $29.53 \times 2 = 59.06$ days long while the number of days of a full and a hollow month is only equal to only $29 + 30 = 59$ days. If the numbers of hollow and full months were equal in all lunar years, the deficit of 0.06 days would thus inevitably lead to an indefinitely increasing drift of the calendar. Therefore, the numbers of full and hollow month cannot always remain identical.

More precisely, an alternating sequence of $2x$ lunar months, x full and x hollow, produces a shift of $d = 2 \times 29.53x - (30x + 29x)$ days or $0.06x$ days (or, of course, a slightly different value according to the chosen mean value of the lunar month). With $x = 1000$, for instance, the shift already reaches sixty days or two full months. If the lunar months of the surface calendar are to remain in phase with the mean lunar month, these sixty days must be added in one way or another to as many hollow months because no full month can have more than thirty days while, on the contrary, a hollow month can always be transformed into a full month with the addition of a single day. Therefore, such an alternating series of months leads to a calendar composed of respectively $1000 - 60 = 940$ hollow months and $1000 + 60$ full months. Hence a proportion of $940/2000 = 47\%$ and $1060/2000 = 53\%$ full and hollow months, respectively. Naturally, the same result could also be easily obtained by counting the total numbers of full and hollow months contained in a great number of years listed in any table of the Chinese calendar. But should a given lunar year necessarily have more full months than hollow months?

Local Patterns of Full and Hollow Months

Not at all: in fact, the local distribution of full and hollow months, with respect to particular years, reveals quite heterogeneous patterns. From tables of the Chinese calendar, it is easy to note that fully regular years, i.e. years composed of a simple alternation of full and hollow months (either $29, 30, 29, 30, \ldots$ days or $30, 29, 30, 29, \ldots$ days) are rather common. For example, the years 182, 186, 191, 347, 351 and 392, are made of a regular succession of full (F) and hollow(H) months, beginning with either a full month (like the first four years) or a hollow month (like the last two years). Other years, such as the year 183, obey a pattern of type $\mathrm{FH}\boxed{\mathrm{FF}}\mathrm{HF}, \ldots$ displaying two consecutive full months in third and fourth position. This kind of succession of lunar months is also rather frequent, particularly in calendars prior to the Tang dynasty, but the ranks of the two successive full months are not necessarily always identical. In fact, they are not restricted in any way. In the case of the year Huangchu 4 (223), for example, the two full months are the ninth and the tenth.

Still other years contain not only two consecutive full months but also two consecutive hollow months at the same time. Such is the pattern of the year Zhenyuan 13 (797): $\mathrm{HFHF}\boxed{\mathrm{HH}}\mathrm{FHFH}\boxed{\mathrm{FF}}$, for instance.

Sometimes too, three or even up to four full months follow themselves uninterruptedly. For example, the year Dali 12 (777) follows the pattern $\mathrm{HF}\boxed{\mathrm{HH}}\mathrm{FHFH}\boxed{\mathrm{FFF}}\mathrm{H}$ and is doubly irregular, owing to its simultaneous successions of two hollow and three full consecutive months.

Similarly, the year 769 ($\mathrm{FHF}\boxed{\mathrm{HHH}}\boxed{\mathrm{FF}}\mathrm{H}\boxed{\mathrm{FFF}}$) displays at the same time three consecutive hollow months and also two groups of two and three consecutive full months, respectively.

Lastly, the year Shengong 2 (697) ($\mathrm{FHF}\boxed{\mathrm{HH}}\ \mathrm{FHFH}\boxed{\mathrm{FFFF}}$) has four consecutive full months. This last case is nonetheless the only one of its kind.

The arrangements of full and hollow months actually attested in calendars thus reflect various patterns and an examination of available tables of the Chinese calendar clearly reveals that the peculiarities of any given year in this respect cannot be deduced from the monthly surface structure of previous lunar years, independently of the complex calculations of its deep structure. For calendar users, the actual successions of full and hollow months are unpredictable from year to year even though they have been obtained from wholly deterministic processes.

Obviously, these characteristics are very different from those of the Julian and Gregorian calendars where January always has 31 days, February 28 or 29 days, according to the regular pattern of bissextile years, March 31 days and so on.

It is probably for this reason that the full list of lunar months, with the indication of their full or hollow character, is often explicitly mentioned in the preliminary part of Chinese calendars, even though this kind of data is redundant since the body of the calendar itself necessarily also indicates the number of days of each lunar month.

The Astronomical Months and the Lunisolar Coupling

Towards the end of the nineteenth century, historians of Chinese astronomy have enumerated the ordinary lunar months of the Chinese calendar by means of the twelve terrestrial branches *dizhi* 地支 of the duodecimal cycle,[30] and have called them 'astronomical months' *tianwen yue* 天文月, because the structure of the Chinese calendar is such that its lunar months are connected to the solar year, that is to an astronomical type of year,[31] in a fixed manner: by construction, the first astronomical lunar month contains the winter solstice – the first solar breath, q_1. Still, this q_1 is not necessarily identical with its astronomical counterpart, but it belongs to any of the 29 or 30 days of the lunar month in question.

Then, solar breaths are enumerated from q_1 and each lunar month is calculated in such a way that it always contains a unique odd solar breath, located in any of its 29 or 30 days and never in another lunar month. The fixed – and one-to-one – correspondence between the twelve 'astronomical' lunar months, m_i, and the twelve odd solar breaths, q_i, is thus the following:

---

[30] See p. 81 below.

[31] See, for instance, P. Hoang 1910/1968*, p. III.

Months	m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8	m_9	m_{10}	m_{11}	m_{12}
Breaths	q_1	q_3	q_5	q_7	q_9	q_{11}	q_{13}	q_{15}	q_{17}	q_{19}	q_{21}	q_{23}

This correspondence, defining what will be called 'the lunisolar coupling' in what follows, is of course essential but it should be noted that, in practice, lunar months are not enumerated only as shown in this table because the way the beginning of the lunar year is determined is generally not such that the first month of the lunar year m_1 is coupled with the winter solstice q_1 (see *The Beginning of the Lunar Year*, p. 76 below), the first odd solar breath.

In Chinese sources, odd solar breaths are called *zhongqi* 中氣, a term often left untranslated or interpreted as meaning 'median *qi*', on the basis of a classical gloss stating that *zhongqi* appear in the *middle* of lunar months.[32] Yet, solar breaths most often occur elsewhere. Consequently, the rendering '*zhong* 中 = middle' seems dubious, even though 'middle' is one of the possible meanings of this 中. In fact, the *Shuowen jiezi* 説文解字 (*ca*. 100 BC) – a famous etymological dictionary of single Chinese characters from the Han period – gives weight to another equivalence, namely '*zhongqi* = internal breath' for it defines the character *zhong* 中 in the following way: *zhong nei ye* 中内也, i.e. "*zhong* means inside."[33]

Any individual odd solar breath is thus attributed to some day of the lunar month coupled with it, no matter whether the day in question belongs to its beginning, middle or end. What is important is its occurrence inside the same month: only the fact that a fixed odd solar breath always 'resides' inside a given month, determined once and for all by the lunisolar coupling, is important. The 'refusal of entry' of a solar breath into other lunar months than the one determined by the lunisolar coupling is a fundamental principle of all *official* Chinese calendars belonging to our period of study (unofficial Chinese calendars do not necessarily respect this principle).[34]

[32]DKW , 1-291-77:117.

[33]*Shuowen jiezi*, *j*. 1a, p. 14 (from the edition of the text published in Beijing in 1965 by *Zhonghua shuju*).

[34]For instance, the non-official calendar P3247 v°, from the Pelliot collection of Dunhuang manuscripts preserved at the Bibliothèque nationale de France, Paris, designed

Solar breaths which are not internal – those of even order – are called *jie* 節, that is 'bamboo nodes', 'joints' or still 'articulations'. However, this term is not very precise since it more generally qualifies any solar breath, whether of even or odd order. For example, the expression 節*bajie* 八節 'the Eight Nodes' (see p. 64 above), designates a group of eight solar breaths, some being odd and others even, such as q_4 and q_1. Even solar breaths, however, are not subjected to the lunisolar coupling. Consequently, they are liable to belong to two different lunar months.

The number of days between two consecutive solar breaths being equal to approximately 15 days, when an odd solar breath happens before the middle of its month, the preceding even solar breath necessarily belongs to the preceding month. By contrast, when an odd solar breath happens after the middle of its month, the preceding even solar breath belongs to the same lunar month. Therefore, it is impossible to determine once and for all whether or not a given lunar month contains a given even solar breath. However, any ordinary lunar month certainly contains two solar breaths, one of odd order, known in advance as a consequence of the lunisolar coupling, and the second one of even order: if q_{2i+1} belongs to the lunar month m then it also contains either q_{2i} or q_{2i+2} but not both. In other words, the pair of solar breaths associated with m is either (q_{2i}, q_{2i+1}) or (q_{2i+1}, q_{2i+2}). In spite of this double possibility, the Chinese regroup odd and even solar breaths into inseparable pairs, linked to the same lunar month each time, as follows: (q_{24}, q_1), (q_2, q_3), …, (q_{22}, q_{23}). For example, q_{24} and q_1 are respectively called *shiyiyue jie* 十一月節 and *shiyiyue zhong* 十一月中, that is 'even solar breath of the eleventh month' and 'odd solar breath of the eleventh month'.[35] With such a nomenclature, each solar breath of even order is artificially linked with the same month as the following solar breath, as if it were depending on the lunisolar coupling whereas nothing of the

for the year Tongguang 4 (926), violate the lunisolar coupling since the second day of its intercalary month 1* contains the odd solar breath q_5 (Rain Water) which normally only belongs to the first lunar month. See Deng Wenkuan 1996, p. 390; A. Arrault and J.-C. Martzloff 2003, p. 156–158.

[35]The complete list of these appellations appears, in particular, in the following sources: *Weishu*, *j.* 107B, 'lüli zhi 3b', p. 2703–2704; *Jinshu*, *j.* 18, 'lüli 3', p. 541–543.

sort exists. As might be expected, the case of intercalary months is quite different since they are defined in the following way:

Definition 2.1 (Intercalary month) With respect to the surface structure of the calendar, a month devoid of any odd solar breath is an intercalary month.[36]

From this definition, it follows that intercalary months are excluded from the lunisolar coupling and that, when a month is intercalary, there is a couple of odd solar breaths respectively located just before its first day and after it last day, respectively. In other words, this particular kind of month is included in the solar month determined by the two odd solar breaths in question. Consequently, it necessarily contains an even solar breath falling in its middle.

The Beginning of the Lunar Year

In general, the beginning of the Chinese lunar year is mostly fixed in three ways, traditionally believed to have been determined by the Xia 夏, Shang 商 (or Shang-Yin 商殷) and Zhou 周 calendrical norms, the *san zheng* 三正, respectively, in reference to the supposed modes of determination of the beginnings of lunar years during these mythical or historical dynasties. In addition, some Chinese concordance tables also indicate an unnamed fourth way of determining the beginning of the lunar year, supposed to have existed from 324 to 256 BC, 255 to 207 BC and 206 to 103 BC.[37]

More precisely, the way lunar months are enumerated according to these four possibilities needs to take into account the following enumerative elements of the Chinese calendar:

1. the terrestrial branches, composed of twelve elements,[38] enumerated as follows: *hai* 亥, (the twelfth branch) to *zi* 子, *chou* 丑, ...i.e. in the unusual order $12, 1, 2, \ldots, 12$;

[36] See *Hou Hanshu*, zhi 3, 'lüli 3', p. 3058.

[37] P. Hoang 1910/1968*, p. IV. This putative fourth possibility is not often mentioned in contemporary publications and should be reexamined to the light of contemporary archeological findings.

[38] See p. 81 below.

2. the 12 odd solar breaths enumerated in the following order: q_{23}, $q_1 \ldots, q_{21}$;

3. the ranks attributed to the lunar months according to the four modes of determination of the beginning of the year (four last lines).

Then, the following table indicates the ways these various elements are associated with each other:

		12	1	2	3	4	5	6	7	8	9	10	11
Terrestrial branches		*hai*	*zi*	*chou*	*yin*	*mao*	*chen*	*si*	*wu*	*wei*	*shen*	*you*	*xu*
		亥	子	丑	寅	卯	辰	巳	午	未	申	酉	戌
Odd Breaths		q_{23}	q_1	q_3	q_5	q_7	q_9	q_{11}	q_{13}	q_{15}	q_{17}	q_{19}	q_{21}
		Lunar Months											
Xia	夏	10	11	12	1	2	3	4	5	6	7	8	9
Shang	商	11	12	1	2	3	4	5	6	7	8	9	10
Zhou	周	12	1	2	3	4	5	6	7	8	9	10	11
Fourth Possibility		1	2	3	4	5	6	7	8	9	10	11	12

Table 2.1. The four possible modes of enumeration of the Chinese lunar months.

We now have everything we need in order to determine the beginning of any lunar year of the Chinese calendar and, of course, to enumerate all its other months. For instance, this table indicates that, according to the Xia norm, the first lunar month is coupled with the solar breath q_5 and associated with the third terrestrial branch, *yin* 寅.

This example might seem quite particular, perhaps, but, in fact it is extremely important because, in practice, the years of the interval 104 BC–AD 1644, have known no other norm than the Xia 夏 norm[39] save the two following temporary exceptions: the Zhou 周 norm has been restored under the Tang dynasty (618–907), between 690 and 700 and in 762. More generally, it has not been modified later and is still observed now, in non-official traditional Chinese calendars, always popular in China.[40]

[39] See P. Hoang 1910/1968*, p. III and IV.

[40] The official People's Republic of China calendar is a simplified version of the Gregorian calendar, resulting from a calendar reform initiated in 1912 but accepted after many vagaries, many years after the establishment of the Chinese Republic in 1911.

Dynastic Eras and Concordance Tables

The naming of Chinese lunar years by means of dynastic eras is first attested in 140 BC[41] and has been followed until the overthrow of the last Chinese dynasty, in 1911. According to this system, each dynasty is divided into one or several eras having a particular name and their successive lunar years are enumerated in the following way: the first is called *yuannian* 元年 (initial year), the second *ernian* 二年, the third *sannian* 三年 and so on.

The same technique is of course quite widespread outside China too, successive dynastic eras follow one another without regularity: sometimes, certain eras last several decades while others are reduced to one or two years. No less strikingly, identical names of dynastic eras often refer to different dynasties and periods of time. But beyond this already significant complexity, the overall system is still more intricate because the Chinese Empire has often been divided. Hence the existence of parallel dynasties, making the Chinese chronological system almost hopelessly irregular.

It therefore seems uneasy to get one's bearings in this chronological chaos. However, available concordance tables[42] between the Chinese and Western calendars have solved the question at best, notwithstanding a number of difficulties not often taken into account. For instance, the precise dates of the beginnings of such and such a new dynastic era do not necessarily correspond with the beginnings of lunar years, but this point is seldom clarified.[43] Moreover, unexpected delays between the official adoption of a new dynastic era and the impact of this decision over the Chinese territory sometimes exist: in certain peripheral regions,

---

In fact, the old Chinese calendar was abolished by the Nationalist government only in 1928. Moreover, in the system adopted in the Republic of China, years are counted inclusively from 1912, the first year of the Republican era. See L.J. Harris 2008; E.P. Wilkinson 2012, p. 507.

[41] Li Chongzhi 1981/2006*, p. 1. Other naming peculiarities concerning more ancient times have been convincingly highlighted by R.H. Gassmann 2002 (see also p. 373 below).

[42] For an overview of these tables, see p. 371 below.

[43] Chen Yuan 1926/1999* is an exception in this respect.

dynastic eras have been episodically left unmodified up to several years after their disappearance.[44]

Cycles and Pseudo-Cycles

Definitions

The Chinese calendar contains numerous cycles applied to the enumeration of its discrete units: days, lunar months, years and even double-hours dividing the day into twelve equal parts.

The most fundamental cycles are composed of a small number of elements, from the seven days of the planetary week to the sixty elements of the sexagenary cycle but, when combined with each other, they also give rise to a number of supra-annual cycles.

Cycles can be simple, simultaneous or with reduplications and the latter can also be referred to as 'pseudo-cycles', the resulting sequences being not necessarily cyclical.[45] Hence the three following informal definitions:

Definition 2.2 (Simple Cycles) Simple cycles are those composed of any discrete sequence of elements enumerated cyclically.

Definition 2.3 (Simultaneous Cycles) Simultaneous cycles are those obtained from the simultaneous enumeration of several simple cycles.[46]

Definition 2.4 (Reduplications) When numbering instructions lead to repetitions of elements according to more or less complex rules, the resulting sequences are said to have 'reduplications'. They can be cyclical or not.

The chronology of the introduction of these various kinds of cycles and pseudo-cycles into the official Chinese calendar is not well known, even to within several centuries.

[44]This point has been clearly established for the region of Dunhuang . See A. Arrault 2003, p. 93.

[45]See p. 94 below.

[46]N. Dershowitz and E.M. Reingold, 1997, p. 19 f. offer a useful mathematical presentation of this notion.

The Denary Cycle

The denary cycle, most commonly referred to as the 'heavenly stems', *tiangan* 天干, or trunks, is a simple cycle composed of the following ten elements:

jia	*yi*	*bing*	*ding*	*wu*	*ji*	*geng*	*xin*	*ren*	*gui*
甲	乙	丙	丁	戊	己	庚	辛	壬	癸

These trunks are probably more ancient than the origin of writing in China. From recent investigations, it appears that they were crucially related to the calendar in the same way as the terrestrial branches (see p. 81 below), in a period were writing was still not used for other purposes.[47] During these remote periods, they were used for counting days by decades[48] (*xun* 旬) and, in particular, most Chinese classics mention this notion.[49]

Their etymology is obscure. All sorts of hypothesis have been formulated in this respect, but none has definitely gained the favor of sinologists. The historian of astronomy Chen Zungui believes that they derive from pictograms representing the head, the neck, the shoulders and other parts of the human body.[50] The famous man of letters and historian of ancient China, Guo Moruo 郭沫若 (1892–1978), associates them, more generally, with representations of the body of a fish (head, viscera, tail, etc.) and daily life objects (knifes, spears, halberds).[51] Starting from a quite different kind of hypothesis which would be revolutionary if it were confirmed, the Anglo-Canadian sinologist and linguist E.G. Pulleyblank, has supposed that the ten trunks have been used as phonograms during the second millennium before our era, that is as purely phonetical symbols used in order to indicate the pronunciation of Chinese words.[52] But this hypothesis has been rejected later by his author and not a single specific example of such a usage of trunks has been established.

[47] Li Feng and David Prager Branner 2011, p. 28–29.
[48] E.L. Shaughnessy 1999, p. 20.
[49] DKW, 5-748:13746.
[50] Chen Zungui 1984, note 3, p. 1352.
[51] Ibid., note 2, p. 1353.
[52] E.G. Pulleyblank 1991a.

Anyway, during their long history, the trunks have become abstract symbols, used for naming all sorts of discrete series, in no way limited to calendrical matters. For instance, they have been used in order to designate unnamed things in mathematical problems from the Han period, anonymous characters in a play, and the equivalent of letters in geometrical figures from the beginning of the seventeenth century, when mathematical works of European origin were first translated into Chinese by Jesuit missionaries.

The Duodecimal Cycle

The duodecimal cycle, also referred to as the 'terrestrial branches' *dizhi*, 地支 is a simple cycle composed of the following elements:

zi	*chou*	*yin*	*mao*	*chen*	*si*	*wu*	*wei*	*shen*	*you*	*xu*	*hai*
子	丑	寅	卯	辰	巳	午	未	申	酉	戌	亥

In calendars, they appear either as second elements of sexagenary binomials or independently. In the latter case, they serve to record the twelve Chinese double-hours or, notably, the cycle of the twelve animals (Table 2.2 below). In particular, this famous zoomorphic cycle is extremely ancient and already appears in manuscripts unearthed at Shuihudi (Hubei, third century BC).[53] Its history is complex. Funerary statuettes representing either animals or hybrid beings, half-animal half-human, have been discovered. Moreover, it has been established that the twelve animals were not associated only with lunar years but also with lunar months and calendrical spirits and that they were divided into two modes of divination, depending on either the year of birth[54] or the date

[53]M. Loewe 1994, p. 214 f. and M. Kalinowski 2003, p. 228–229, mentions numerous references in this respect.

[54]Historically, the twelve animals have nothing to do with the zodiac since they do not refer to zones of the celestial sphere. Nonetheless, the zodiac has been transmitted in China under the Sui dynasty (589–618) at the latest through the diffusion of Buddhism (Chinese translations of Sanskrit works). Moreover the zodiac is mentioned in a famous treatise of astrology also influenced by Indian culture, the *Kaiyuan zhanjing* 開元占經 (*Kaiyuan reign-period (713–742) Treatise on Astrology*). Lastly, various wall paintings from the Xth–XIIth centuries, from Dunhuang and elsewhere, also witness the introduction of the zodiac in China (Xia Nai 1989, p. 306 f., Chen Meidong 2003a,

of birthday.[55] Drawings of the twelve cyclical animals sometimes exist in ancient almanacs. In the two almanacs S-P6 r° and S612 r° from Dunhuang, dated 877 and 978, for example, they are represented either directly or in the form of designs appearing on the hats of functionaries.[56] But, as a rule, one cannot expect to see them in calendars, save indirectly, from their tacit correspondence with each term of the duodecimal cycle.

zi	子	*shu*	鼠	Rat
chou	丑	*niu*	牛	Ox
yin	寅	*hu*	虎	Tiger
mao	卯	*tu*	兔	Rabbit
chen	辰	*long*	龍	Dragon
si	巳	*she*	蛇	Snake
wu	午	*ma*	馬	Horse
wei	未	*yang*	羊	Goat
shen	申	*hou*	猴	Monkey
you	酉	*ji*	雞	Rooster
xu	戌	*gou*	狗	Dog
hai	亥	*zhu*	豬	Pig

Table 2.2. The twelve animals and their correspondence with the twelve terrestrial branches.

The Inverted Tree

In writings about the Chinese calendar, the two enigmatic appellations '*heavenly* stems' and '*terrestrial* branches' are generally left unexplained. Fortunately, however, a researcher from Bonn University, Jörg Bäcker, has recently established that they are not earlier than the

p. 394–396). Nevertheless, authentic Chinese calendars which have been handed down to us never refer to it.

[55]M. Kalinowski 2003, ibid., p. 228–229. On the less ancient cycle of the twelve animals in the Turkish world, see L. Bazin 1991, p. 123 f.

[56]A. Arrault 2003, p. 201 and p. 183.

Han dynasty and that they are related to Indian cosmological ideas and a number of various other ancient traditions.

More precisely, they evoke the image of an inverted tree whose stem (or trunk, including its roots) 'sinks' into the sky while its branches 'rise' to the earth. We are thus here in presence of the most archaic form of the cosmic tree, a tree which is omnipresent in Indian philosophy from the Vedic period.[57]

More generally, this *arbor inversa* is also documented in the Arabic, Hebraic, Icelandic, Finnish and Siberian traditions.[58] A new insight into an apparently unsolvable problem has thus been obtained from a wide understanding of non-Chinese questions.

The Sexagenary Cycle

Among the numerous enumerating techniques for days, lunar months and years, the sexagenary cycle is the backbone of Chinese calendars, from the oldest to the latest.

Formally, it can be described in terms of ordered pairs, or binomials (a_i, b_j) $1 \leq i \leq 10$ and $1 \leq j \leq 12$, where the a_i and b_j are respectively a trunk and a branch, enumerated simultaneously and cyclically. The first ten binomials are thus $(a_1, b_1), (a_2, b_2), \ldots, (a_{10}, b_{10})$. Then, the ten trunks being exhausted, they are then reused from a_1 so that the eleventh binomial is (a_1, b_{11}) and the twelfth (a_2, b_{12}). Similarly, the enumeration starts anew from b_1. Hence the new pairs $(a_3, b_1), (a_4, b_2), (a_5, b_3) \ldots$ and so on, up to (a_{10}, b_{12}), the sixtieth. The binomials so listed are of course all different and, beyond the last, the same enumeration technique reproduces endlessly the same ones which are thus more precisely called '*sexagenary binomials*'.

The earliest full representation of the whole cycle dates back to the Shang-Yin dynasty, where these binomials are listed into six successive

---

[57] "Un tel arbre, avec ses racines dans le ciel et ses branches pendant vers le bas est omniprésent dans toute la philosophie indienne depuis l'époque védique; see Rig-Veda, I, 27, 7: "C'est vers le bas que se dirigent les branches, c'est en haut que se trouve sa racine, que ses rayons descendent sur nous!" " ("Such a tree, with his roots in the sky and his branches hanging down, is omnipresent in Indian philosophy since the Vedic period; see *Rig-Veda*, I, 27, 7: "Its branches head downwards, its stem is situated upwards, its rays stream downwards upon us!" ") (J. Bäcker 2007, p. 64).

[58] J. Bäcker, ibid., p. 64–65, provides numerous references in this respect.

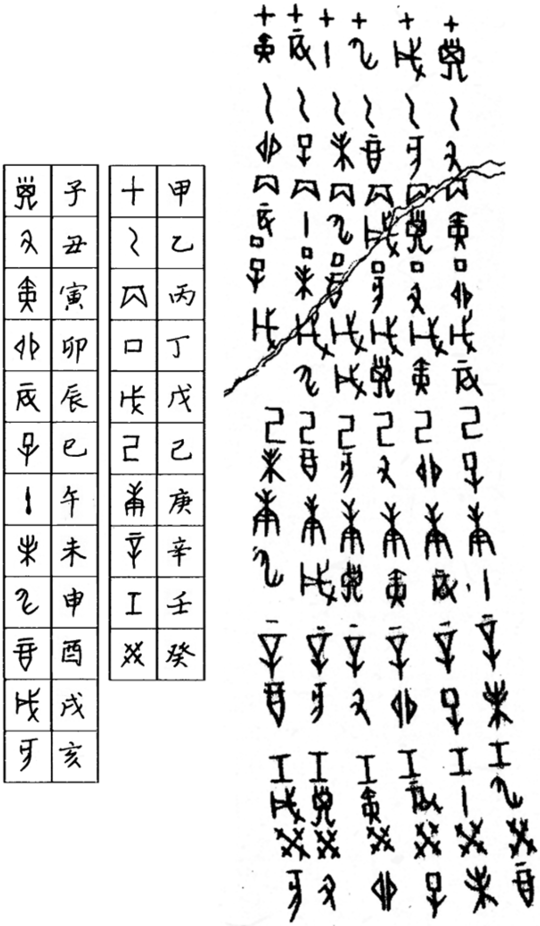

Figure 2.1. The earliest known representation of the sexagenary cycle is recorded in divinatory inscriptions on bones and turtle shells from the Shang period. The diagram on the right shows the written part of a shoulderblade, the only extant piece from this period containing a complete list of the sexagenary binomials. From this reproduction and from the correspondence between the ancient and modern forms of the trunks and branches given on the left, it appears that this list is composed of six columns, enumerated in canonical order from $(1, 1)$, *jiazi* 甲子, to $(10, 12)$, *guihai* 癸亥, in groups of ten. See Guo Moruo 1978–1982, item no. 37986.

columns, each composed of ten elements (Fig. 2.1), p. 84). Later, the same enumerative pattern, highlighting likewise the six decades of the sexagenary cycle, has been often used. But when correlations between the sixty binomials and other cycles had to be displayed, circular patterns, such as those used in geomancy, are also extremely common.

A simplified notation, more appropriate for mathematical purposes, is obtained by replacing the a_i and by b_i, by their ranks in their respective series. Hence binomials such as $(1,1)$ or $(7,11)$ instead of (a_1,b_1) and (a_7,b_{11}) or (*jia*, *zi*) 甲子 and *gengxu* 庚戌), respectively. Still more simply, any binomial will also be designated by its rank, denoted #1, #2 ...#60 instead of $1,2,\dots 60$ in order to avoid any confusion with ordinary integers. For instance, #54 will refer to $(4,6)$ or *dingsi* 丁巳.

		branches											
		1	2	3	4	5	6	7	8	9	10	11	12
trunks	1	1		51		41		31		21		11	
	2		2		52		42		32		22		12
	3	13		3		53		43		33		23	
	4		14		4		54		44		34		24
	5	25		15		5		55		45		35	
	6		26		16		6		56		46		36
	7	37		27		17		7		57		47	
	8		38		28		18		8		58		48
	9	49		39		29		19		9		59	
	10		50		40		30		20		10		60

Table 2.3. the sixty sexagenary binomials.

In order to determine the rank of a given binomial (a,b), an easy rule of thumb is available[59] but the most straightforward method still consists in using a double-entry table (Table. 2.3), the reverse correspondence being also easily available at the same time. However, no such table is attested in Chinese sources. Rather, binomials were often listed as in Fig. 2.1, p. 84 above, and given that with such a pattern the sixty binomials are regularly listed in six successive columns, composed

[59] See Appendix A.

of ten binomials each, the top one always beginning with *jia* 甲, some more direct mnemotechnical rule, for determining their ranks and for the reverse operation, have probably been used instead.[60]

Various Uses of the Sexagenary Cycle

Enumeration of Days

The sexagenary cycle was first used for enumerating sequences of days at a very early date, impossible to determine precisely but probably going back to the Shang-Yin dynasty (1765–1122 BC). Historians of China also believe that the same technique has been used without any interruption, from an unknown early period, until now. However, the days so enumerated have not necessarily always been defined in the same way.

Enumeration of Years

From the Spring and Autumn period (722–481 BC), the twelve branches have been used in order to number years by analogy with the sidereal period of revolution of Jupiter, a period approximately equal to twelve years.[61]

Much later, during the Later Han at the earliest, the sexagenary binomials served the same purpose.[62] This innovation made its way into calendars much later, however, viz. in those of the Tang dynasty (618–907), many centuries later.

Enumeration of Months

During the Tang dynasty, the sexagenary cycle was also used for enumerating ordinary lunar months, according to a supra-annual cycle composed of $12 \times 5 = 60$ months or 5 years.[63] In this manner, the sixty binomials have been associated one by one with successive ordinary lunar months, intercalary months being skipped.

---

[60] Simultaneous cycles similar to the sexagenary cycle are of course also attested elsewhere than in China. For the most recent presentation reflecting the state of the art in the Mesoamerican domain, see A. Cauty 2012.

[61] Chen Zungui 1984, p. 1358–1363.

[62] The astronomical canon of the *Hou Hanshu* (zhi 3, ‘lüli 3’, p. 3061–3062) contains a table indicating the sexagenary numbers of the first lunar years of a series of supra-annual periods (or cycles) composed of 76 solar years each.

[63] Deng Wenkuan 1998a, p. 613, ‘*yuejian ganzhi*’ 月建干支 (sexagenary enumeration of lunar months).

Less obviously, but in accordance with the Xia norm, used during the majority of years between 104 BC and AD 1644,[64] this lunar enumeration always begins with an eleventh lunar month. Consequently, the months corresponding to #1 and #2 are respectively an eleventh and twelfth month of the lunar year preceding the first lunar year of this enumeration. In its turn, the month #3 is the first lunar month of the first year so enumerated. From this peculiarity, it follows that the whole cycle is exhausted after 5 years composed of 12 enumerated months each (and some non-enumerated intercalary months). Hence the following table, showing the correspondence between sexagenary binomials and lunar months, over a period of five consecutive years:

	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Year 1	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14
Year 2	#15	#16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26
Year 3	#27	#28	#29	#30	#31	#32	#33	#34	#35	#36	#37	#38
Year 4	#39	#40	#41	#42	#43	#44	#45	#46	#47	#48	#49	#50
Year 5	#51	#52	#53	#54	#55	#56	#57	#58	#59	#60	#1	#2

Table 2.4. The sexagenary enumeration of lunar months.

With this quinary pattern, the binomials associated with any month of any given year are easily obtained. For example, since the binomial of the 11^{th} month of the year 803 (Zhenyuan 19) is $(1,1)$ or *jiazi* 甲子,[65] all 11^{th} months of years of the form $803+5k$, $k = \ldots -2, -1, 0, 1, 2, \ldots$ are associated with the same binomial. However, the starting date of this enumerating system is unknown.

The Nine Color Palaces

The nine color palaces, *jiu gong* 九宮, are small squares divided into nine smaller squares, or ‘palaces’, *gong* 宮, containing the following seven names of colors: white *bai* 白, black *hei* 黑, azure *bi* 碧, green lü 綠, yellow *huang* 黃, red *chi* 赤, and purple *zi* 紫, arranged in such a way that these squares are associated in a fixed way with numbers from one to nine (Table 2.5).

[64] See p. 76 above.

[65] This fact readily obtained from any extensive table of the Chinese calendar.

A replacement of the colors by their associated numbers also shows that the nine corresponding squares are all different and follow a quite regular pattern: when they are listed in their order of succession attested in calendars and replaced by the number of their central square, they succeed one another in reverse order (Table 2.6).

white	black	azure	green	yellow	red	purple
bai	*hei*	*bi*	*lü*	*huang*	*chi*	*zi*
1, 6, 8	2	3	4	5	7	9

Table 2.5. The correspondence between colors and the central numbers of color palaces.

9	5	7		8	4	6		7	3	5		6	2	4		5	1	3
8	**1**	3	→	7	**9**	2	→	6	**8**	1	→	5	**7**	9	→	4	**6**	8
4	6	2		3	5	1		2	4	9		1	3	8		9	2	7
	1				9				8				7				6	

4	9	2		3	8	1		2	7	9		1	6	8		9	5	7
3	**5**	7	→	2	**4**	6	→	1	**3**	5	→	9	**2**	4	→	8	**1**	3
8	1	6		7	9	5		6	8	4		5	7	3		4	6	2
	5				4				3				2				1	

Table 2.6. The nine color palaces and their representative numbers (central squares).

In addition, a further examination of these squares also reveals that each of them is deduced from its predecessor by first replacing their central one by nine and by subtracting one unit from all other digits and then by a series of similar subtractions.

Like the sexagenary cycle, the nine color palaces are used in order to number years, months and even days. But the latter mode of enumeration has apparently been used very scarcely.[66]

[66]To my knowledge, only four examples of days numbered by means of color palaces are documented in extant Chinese calendars. See A. Arrault 2003, p. 109.

Enumeration of Years

The beginning of the enumeration of years with color palaces is traditionally attributed to the year 604 (Renshou 4, Sui dynasty).[67] The years 604, 605, 606 … are thus successively numbered 1, 9, 8 and so on, in reverse order. Incidentally, it also happens that the sexagenary binomial of the initial year, 604, is *jiazi* 甲子 or $(1,1)$.

The color palaces repeating themselves every nine years, the years of the Chinese calendar fall accordingly into nine categories, as the following table indicates:

Palaces	1	2	3	4	5	6	7	8	9
Years	9*k*+1	9*k*	9*k*–1	9*k*–2	9*k*–3	9*k*–4	9*k*+4	9*k*+3	9*k*+2

Table 2.7. The enumeration of years with color palaces (k is a positive or negative integer).

Moreover, given that 604 mod 9 $=1$, the years associated with the first color palace are such that x mod 9 $=1$. Likewise, those associated with the ninth color palace are of the form $x=9k+2$. More generally, years mutually differ according to the value of x mod 9. Hence the above table.

Color palaces are also linked to the sexagenary enumeration of years, thus producing 3 supra-annual periods of 60 years each: the least common multiple of 9 (number of color palaces) and 60 (number of sexagenary binomials) is indeed equal to 180 and 3 cycles of 60 years exhaust all possibilities in this respect. The first such cycle of 60 years is called *shang yuan* , 上元 (initial cycle), the second *zhong yuan* 中元 (median cycle) and the third *xia yuan* 下元 (final cycle).[68]

Enumeration of Lunar Months

An analysis of calendars having their months numbered backwards with color palaces shows that the first months of *jiazi* years have an eight in the central square of their color palace.

[67] This date is first mentioned in the *Suishu* (*j*. 69, 'liezhuan 34', p. 1611) See A. Arrault 2003, ibid., note 100, p. 109.

[68] *Suishu*, ibid.

From this fact and from a backwards enumeration of the following months it follows that the first month of the second and third years are respectively equal to 5 and 2, intercalary months being skipped, as usual. Consequently, as the starting year is a *jiazi* 甲子 year, the first months of three successive years are always numbered 8, 5 and 2. More generally, the following table gives the enumeration of all other months:

Month no.		1	2	3	4	5	6	7	8	9	10	11	12
Palace	1st Year	8	7	6	5	4	3	2	1	9	8	7	6
	2nd Years	5	4	3	2	1	9	8	7	6	5	4	3
	3rd Year	2	1	9	8	7	6	5	4	3	2	1	9

Table 2.8. The enumeration of lunar months with color palaces represented by the number of their central square.

More mathematically, this regularity comes from the fact that the least common multiple of the number of color palaces, 9, and of the number of ordinary months in a year, 12, is equal to 36 or three lunar years.

Once again, the starting year of this enumeration is unknown but, for example, when starting enumerating backwards lunar months from the first color palace and from the eleventh month of the year 603, in order to obtain an enumeration starting from the same year as the one first historically used for enumerating years with them, the first month of the year 604 is numbered ‘8’.

Then, the numbers of the successive years reproduce themselves indefinitely in the order 8, 5, 2 and since the year 604 is of the form $3k+1$, the first months of all years of the same form are also numbered ‘8’. Likewise, the first month of years $3k+2$ and $3k$ are respectively associated with the color palaces 5 and 2.

The Planetary Week

The planetary week[69] was first introduced in China by the so-called Nestorians or, more exactly, the members of the East-Syrian Christian

[69] The planetary week and its seven days is extremely ancient and is so called with reference to a conception according to which the sun and the moon, respectively associated with Sunday and Monday, are included among the planets, the antique notion

Church (Christian community of the Sasanian world),[70] in 781, and a Chinese neologism meaning Sunday was then coined for the first time: as the famous French sinologist Paul Pelliot has shown, the word *yao-senwen* 曜森文, inscribed at the end of the famous Nestorian stele discovered at Xi'an and dated to the 7th day of the 1st [lunar] month of the Jianzhong era of the Tang dynasty (Julian date: Sunday[71] 4/2/781) – corresponds to a Chinese phonetic transliteration from the Pehlvi *ev-šambat*[72] meaning 'Sunday'.[73] As far as we know, this term is a hapax and has not been recorded in Chinese calendars handed down to us.

From the tenth century of our era, approximately, Sundays of the planetary week have made their way into Chinese calendars and have been denoted by the character *mi* 蜜 or its homophone *mi* 密. No matter which *mi* was used, the introduction of the planetary week in Chinese calendars was probably triggered by the diffusion of manicheism from Persia, *mi* being probably a transcription of *mir*, the name of the solar divinity (Mithra).[74]

If the *mi* Sunday is conspicuous, other weekdays also appear in calendars and, from comparative chronology, we know that their Julian day numbers mostly coincide with those of the corresponding weekdays used everywhere in non-Chinese regions of the world.[75]

---

of planet meaning 'wandering star' as opposed to 'fixed stars' and not 'celestial body orbiting the sun or another star'. On the history of the planetary week outside China, see F.H. Colson 1926 and, above all, E. Zerubavel 1985.

[70] See Bill M. Mak 2014, p. 105.

[71] Most importantly, this date is also a Sunday in both Persian and Indian calendars. See Bill M. Mak 2014, op. cit., note 70, p. 119.

[72] This term is equivalent to the modern Persian *yakšambah*.

[73] P. Pelliot 1996 (edited by A. Forte), p. 309.

[74] Numerous studies on this subject have been published. The oldest, but still valuable ones, are A. Wylie 1897/1966* and É. Chavannes and P. Pelliot 1913, p. 171 f. More recent publications such as J. Needham 1959, p. 204; Zhuang Shen 1960; S. Whitfield 1998, p. 6 and A. Arrault 2003, p. 100 are also useful. Lastly, various Chinese sources also mention this question, notably the very important *Xieji bianfang shu*, *j.* 1, p. 98–99 (notice p. 397 below).

[75] A. Arrault and J.-C. Martzloff 2003, p. 100. We also note in passing that Japanese calendars from much later years (1606 and 1648) also have weekdays but the historian of the calendar T. Watanabe 1977/1984*, p. 89, has shown that their dates, deduced from their Julian day numbers, are not identical with the corresponding non-Japanese weekdays.

In the Chinese context, however, Sundays and other weekdays are disconnected from our familiar alternation between work and rest since the Chinese week was based on ten day sequences.[76] On the contrary, the association between weekdays and planets was used in order to determine the auspicious or inauspicious character of all sorts of daily activities. At Dunhuang, during the tenth century, for example, Sunday was deemed auspicious for traveling or searching for lost animals and personal belongings.[77]

From the testimony of the famous British Protestant missionary and sinologist A. Wylie (1815–1887), valid for the end of nineteenth century, as well as those of the French sinologists É. Chavannes and P. Pelliot (1878–1945), Sundays and other days of the planetary week were still in use in Fujian province at the beginning of the twentieth century.[78]

The Twenty-Eight Mansions

While the planetary week has lastingly survived in South China, it has also surreptitiously interfered with the ancient Chinese system of the twenty-eight mansions[79] *ershiba xiu* 二十八宿, a few centuries after its

[76] See Yang Lien-sheng, 1969b.

[77] A. Arrault 2003, p. 100. M. Kalinowski 2003, p. 237–238, also give other such details for days other than Sundays.

[78] "When at Amoy [Xiamen, Fujian province] I procured a copy of the Almanac [...] the *mih jih* [*miri* 蜜日] was certainly recorded throughout under every Sunday [...]". See A. Wylie 1897/1966*, p. 87. The present *mih jih* corresponds to the *pinyin* transliteration *miri*, the *mi* being the same as above while *ri* means 'day'. Consequently *miri* literally means 'Sun day'. See also É Chavannes and P. Pelliot 1913, p. 173: "[. . .] c'est au Fou-kien [Fujian] que, jusqu'à nos jours, le souvenir du dimanche, jour du soleil, a survécu, et sous une appellation sogdienne, or c'est au Fou-Kien même que, du XI^e^ siècle au XIII^e^ siècle, nos textes historiques attestent la présence et l'importance de communautés manichéennes." (It's in Fujian that, until now, the memory of Sunday, understood as a Sun day, has perpetuated itself under a Sogdian appellation. But it's precisely in this province that, from the XI^th^ to the XIII^th^ centuries, our historical texts witness the presence and the importance of Manichean communities.)

[79] The term 'mansion' comes from the Latin *mansio*, a term meaning 'dwelling place', 'lodge', 'station'. In Chinese traditional astrology and astronomy, it refers to the places where certain moving celestial bodies such as the sun, the moon, planets or comets give the impression of resting temporarily. These mansions are often oddly called 'lunar mansions', without much basis (C. Cullen 2011); their possible connection with other stellar systems attested in India and in the Islamic world has given rise to all sorts of insoluble speculations. For a history of the subject, see J. Needham 1959, p. 242 f.;

first apparition in a Chinese context.[80] Most interestingly, as indicated in the following table, each weekday has then been associated with four different mansions. For example, Sunday successively corresponds to *Fang*, *Xu*, *Mao* and *Xing*:[81]

Sunday	4	*Fang*	房	11	*Xu*	虛	18	*Mao*	昴	25	*Xing*	星
Monday	5	*Xin*	心	12	*Wei*	危	19	*Bi*	畢	26	*Zhang*	張
Tuesday	6	*Wei*	尾	13	*Shi*	室	20	*Zi*	觜	27	*Yi*	翼
Wednesday	7	*Ji*	箕	14	*Bi*	壁	21	*Shen*	參	28	*Zhen*	軫
Thursday	8	*Dou*	斗	15	*Kui*	奎	22	*Jing*	井	1	*Jiao*	角
Friday	9	*Niu*	牛	16	*Lou*	婁	23	*Gui*	鬼	2	*Kang*	亢
Saturday	10	*Nü*	女	17	*Wei*	胃	24	*Liu*	柳	3	*Di*	氐

Table 2.9. Correspondence between the days of the planetary week and the twenty-eight mansions, traditionally enumerated from *Jiao* 角 (1) to *Zhen* 軫 (28) (right column).

The transition from the weekday to the 28 mansions cycle does not seem to have been abrupt, however, and the two systems probably coexisted for several centuries.[82] Moreover, even after the disappearance of the explicit mention of weekdays in Chinese official calendars, their underlying existence was still recognizable. Most remarkably, in the first known report on the Chinese calendar ever written in a European language, Portuguese, (August 1612, Beijing), the Italian Jesuit missionary Sabatino De Ursis (1575–1620) judiciously notes that:

see also D.S. Nivison 1989 (proof of existence of two different antique versions of the twenty-eight mansions); Pan Nai 1989*/2009* (very detailed examination of the question based on all known Chinese sources); Sun Xiaochun and J. Kistemaker 1997, p. 26–28 (ancient Chinese star catalogs); Chen Meidong 2003a, p. 67–72 (recent overview of the subject).

[80]M. Kalinowski 1996 provides a careful study of the subject.

[81]Tentative renderings: *Fang*: Chamber, *Xu*: Tumulus ; *Mao*: Pleiads ; *Xing*: Stars; *Xin*: Heart; *Wei*: Rooftop; *Bi*: Net; *Zhang*: Strung Bow; *Wei*: Horn; *Shi*: Hall; *Zi*: Beak; *Yi*: Wings; *Ji*: Winnowing-basket; *Bi*: Wall; *Shen*: Triad; *Zhen*: Chariot Baseboard; *Dou*: Dipper; *Kui*: Crotch; *Jing*: Well; *Jiao*: Horn; Niu: Ox; *Lou*: Pasture; *Gui*: Devils; *Kang*: Neck; *Nü*: Serving-Maid; *Wei*: Stomach; *Liu*: Willow; *Di*: Root. For recent critical observations on this subject see Sivin, N. 2009, p. 90–94.

[82]A. Arrault 2003, p. 101 and, same author, 2004.

> "The Chinese have 28 constellations [...] This is really equivalent to the number 28 of our solar cycle. [...] The four constellations corresponding to the sun always fall on Sunday, those corresponding to the moon always fall on Monday, those corresponding to Mars on Tuesday, and so forth. [...] Christian thus, looking at the calendar, know that the day under which there is one of these four characters [associated with the sun] is a Sunday."[83]

The **Jianchu** *Pseudo-Cycle with Reduplications*

The pseudo-cycle *jianchu* 建除 is so-called from its two first terms, *jian* 建 and *chu* 除. Like many other components of the Chinese calendar, its terms are associated with the auspicious or inauspicious characters of the days they are associated with.[84] Its twelve terms are: *jian* 建 (instauration), *chu* 除 (removal), *man* 滿 (plenitude), *ping* 平 (balance), *ding* 定 (settlement), *zhi* 執 (stability), *po* 破 (destruction), *wei* 危 (danger), *cheng* 成 (maturity), *shou* 收 (reception), *kai* 開 (openness), *bi* 閉 (closure).

In his outstanding study of Turkish calendars, Louis Bazin highlights the divinatory character of this series and calls it 'la série des douze présages' ('the twelve oracle series'); he also analyses the Uyghur roll manuscript ML 21, no. 11 (1202 AD) with a great wealth of details and concludes that the twelve Chinese terms have been transliterated phonetically into the Uyghur language, under the manifest forms *kin*, *čuu*, *man* ...[85]

The *jianchu* pseudo-cycle is also documented much more anciently in bamboo strips, discovered in 1975 at Shuihudi, Yunmeng, Hubei province, in the remains of a tomb sealed in 217 BC. We are dealing here with a series also beginning with the two first *jianchu* terms but its rules and purpose are still not well understood save that, unlike its later version, it was then also used in the enumeration of years.[86] At least from the Tang dynasty, its rules of association with calendrical days have been stabilized as follows:

---

[83]P. d'Elia 1960, p. 73.

[84]For a later period (Qing dynasty (1644–1911) R.J. Smith 1992, p. 81, remarks that the auspicious or inauspicious character of these terms is not fixed once for all. See also *Xieji bianfang shu*, *j.* 4, p. 169 f. (Notice p. 397 below).

[85]L. Bazin 1991, p. 286–292.

[86]M. Loewe 1994, p. 215 and 220 f. ('the system of oracles').

***A* (Starting Point)** Let x be a given year. Then, the first term of the *jianchu* pseudo-cycle, *jian* 建, is attributed to the first day posterior to the even solar breath q_4, *lichun* (Enthronement of Spring), having a sexagenary binomial equal to either #3, #15, #27, #39 or #51 (binomials of the form $3 + 12k$, $k = 0, 1, 2, 3, 4$);

***B* (Reduplications)** Let us suppose that an even solar breath falls on a certain day n. Then, the days n and $n-1$ are assigned the same *jianchu* term;[87]

***C* (Temporary Cyclical Character)** As long as condition *B* is not fulfilled, the *jianchu* terms are enumerated cyclically.

From these rules it follows that:

1. days cannot be enumerated with the *jianchu* terms without a prior determination of the solar breaths of the year x. Hence a fundamental difference between the *jianchu* pseudo-cycle and many other cycles of the Chinese calendar, such as the sexagenary cycle, whose enumeration is never affected in any way by calendrical calculations;

2. the rule ***A*** can be formulated differently by mentioning explicitly the concerned binomials – (1,3), (3,3), (5,3), (7,3) and (9,3) – instead of their ranks. In this way, the fact that all their second terms are all equal to 3 not only becomes obvious but also explains why the original Chinese rule states that the first day posterior to *lichun* and whose branch is the third one, *yin* 寅, is associated with *jian* 建;[88]

3. the rule *B* refers to *even* solar breaths. The terms of the *jianchu* pseudo-cycle are thus reduplicated twelve times during an interval of time equivalent to a calendrical solar year.

---

[87] Deng Wenkuan 1998b.

[88] *Xieji bianfang shu*, *j.* 4, p. 169–170 (see p. 397 below).

The Nayin *Cycle with Reduplications*

The *nayin* 納音 cycle with reduplications concerns the cyclical enumeration of days and years by groups of sixty. Its name literally means 'induced sounds' and alludes to the following correspondence between the five notes of the Chinese scale and the five phases:[89]

1. Metal *Jin* 金, note *Shang* 商 ;
2. Fire *Huo* 火, note *Zhi* 徵 ;
3. Wood *Mu* 木, note *Jue* 角 ;
4. Earth *Tu* 土, note *Gong* 宮 ;
5. Water *Shui* 水, note *Yu* 羽.

However, this correspondence remains tacit and, in practice, the sixty elements of this new cycle are obtained by enunciating twice each phase and by establishing a correspondence with the sixty sexagenary binomials, represented by their rank, from #1 to #10, #11 to #20 and so on. Now, let us write 1, 2, 3, 4, 5 instead of *Jin*, *Huo*, *Mu*, *Tu* and *Shui*.[90] Then #1, #2, #3, #4, ... are respectively associated with 1, 1, 2, 2,... or *Jin*, *Jin*, *Huo*, *Huo*, ... (Table 2.10 below). For instance, the first day of the first month of the year Yongle 15 (1417) is equal to $(5,1)$, or *wuzi* (#25) (see p. 314 below) and, from this table, #25 corresponds to 2, 'Fire'. Consequently, the following days of the same month respectively correspond to $2,3,3,5,5,1,1,\ldots$, or, more explicitly *Huo*, *Mu*, *Mu*, *Shui*, *Shui*, *Jin*, *Jin*, and so on.

Other Aspects of the Chinese Calendar

Festivals and Annual Observances

The Chinese calendar has a large number of festivals and annual observances that bear witness to a rich and complex history, extending over several millennia and still awaiting its historian of religion, mythology, ritual, social phenomena and politics for a global and multidimensional

[89] M. Kalinowski, 2003, p. 220–222.
[90] M. Kalinowski, 2003, ibid., p. 221.

presentation of the subject. In the following, we limit ourselves to the determination of the dates of the main Chinese traditional festivals.[91]

As usual, it is necessary to distinguish between fixed and movable festivals. In the sequel, the term ‘fixed’ designates any festival having a fixed date relatively to its lunar or solar component.

Contrary to what might be expected, the following festivals and special days are not necessarily explicitly indicated in traditional calendars from our period of study. The most famous is, of course, the New Year Festival, held on the first day of the first lunar month (1/I). Documented from the Southern and Northern dynasties (420–589),[92] it was called Yuandan 元旦 for a very long historical period. In a modern context, however, this term designates the non-Chinese Gregorian 1st January while the original Yuandan corresponds to the Spring Festival, Chunjie 春節, because of the proximity between the first day of the Chinese lunar year and the Enthronement of Spring, *lichun*, q_4.

[91] For more details, outstanding works concerning specific festivals, or certain of their aspects, are already available. See, in particular, J. Bredon and I. Mitrophanow 1927, W. Eberhard 1952; Li Yongkuang and Wang Xi 1995 (general works) ; J. Gernet 1959 (last years of the Southern Song dynasty (1250–1276)); D. Bodde 1975 (Han dynasty); Zhou Yiping and Shen Shaying 1991 (dictionary); Tun Li-ch’en 1965 (customs and festivals in Peking); W.C. Hu 1991 (the New Year and its folklore); P. Welch Bjaaland 1997 (the New Year, modern times); E. Trombert 1996 (Dunhuang, socio-economical aspects); E.P. Wilkinson 2012 (all periods and all aspects of the subject, p. 524–526).

[92] Li Yongkuang and Wang Xi 1995, p. 169.

Binomials No.	Phases No.									
#1–#10	1	1	2	2	3	3	4	4	1	1
#11–#20	2	2	5	5	4	4	1	1	3	3
#21–#30	5	5	4	4	2	2	3	3	5	5
#31–#40	1	1	2	2	3	3	4	4	1	1
#41–#50	2	2	5	5	4	4	1	1	3	3
#51–#60	5	5	4	4	2	2	3	3	5	5

Table 2.10. The *nayin* cycle with reduplications and the correspondence between the sexagenary binomials and the five phases (denoted $1, 2 \ldots 5$).

Among the most noticeable other fixed festivals with respect to lunar dates, we note, in particular, the Lantern Festival, Yuanxiao 元宵, (15/I); the Bathing Buddha Festival (anniversary of his birth) Yufodan 浴佛誕, (8/IV); the Double Fifth festival, Duanwu 端午, so-called because it falls on 5/V;[93] the Ghost festival, Yulanpen 盂蘭盆, a name probably originating from the Sanskrit *ullambana* (hanging down) or *ullampana* (salvation) and having given rise to all sorts of conjectural interpretations.[94] During this religious festival, held on 15/VII, people from all walks of life present offerings to Buddhist monks to gain salvation for their ancestors. The 'Double Ninth', Zhongyang 重陽, (9/IX), should also be mentioned. An exhaustive historical list would be considerably longer.

Other festivals, or annual observances, occur on fixed or movable dates with respect to the solar component of the Chinese calendar. They fall into the two following categories: (*a*) event coinciding with a solar breath; (*b*) event falling either a fixed number of days after a solar breath or determined by a more complex rule, generally linked to peculiarities of the sexagenary numbering of days.

For example, the 'Tomb sweeping Festival', Qingming 清明, ('Pure Brightness') belongs to the first category since it coincides with the solar breath q_8, *qingming* 清明.

By contrast, the *wangwang* 往亡 days ('disparition') belong to the second category since they occur a fixed number of days after the 'Enthronements of the four seasons', *si li* 四立, that is after the four following solar breaths: q_4, q_{10}, q_{16} and q_{22}. More precisely, the three spring *wangwang* 往亡 fall 7 days, 2×7 days and 3×7 days after the Enthronement of Spring, *lichun*, q_4; the three summer *wangwang* fall 8 days 2×8 days and 3×8 days after the Enthronement of Summer, *lixia*, q_{10}; the Autumn *wangwang* 9 days, 2×9 days 3×9 days, after the Enthronement of Autumn *liqiu* q_{16}. Lastly, the three winter *wangwang* falls 10 days, 2×10 days 3×10 days, respectively, after the 'Enthronement of Winter', *lidong*, q_{22}.[95]

[93] Other names: Duanyang 端陽 (literally: beginning of the sunny season) and 'Dragon Boat festival' (boat races and competitions were held on that occasion).

[94] See S.F. Teiser 1988, p. 22.

[95] A. Arrault 2003, p. 106.

Similarly, the *san fu* 三伏 (the three days of concealment associated with days of scorching heat or canicular days, dog days) mark the three first days initiating three decades of scorching heat. They are respectively called *chufu* 初伏, *zhong fu* 中伏 and *houfu* 後伏 or *mofu* 末伏, i.e., initial, median and final *fu* (the meaning of the term *fu* is explained in the next paragraph). They fall either after the Summer Solstice or after the Enthronement of Autumn.[96] In both cases, the corresponding days have binomials whose first term is the trunk. *geng* 庚[97] Under the Tang dynasty (618–907), for example, they coincide with three days posterior to the Summer Solstice, q_{13}, whose trunk is *geng*. More mathematically, the first term of their binomials is '7'.

In antiquity, the *san fu* were associated with sacrifices of dogs as a means of prevention against epidemics, insects and various other evils triggered by the hot and humid weather of the sixth month.[98]

Irregular Years

A systematic perusal of almost any table of the Chinese calendar reveals the existence of various sorts of irregular lunar years: the appellations of their lunar months is atypical if not aberrant; the number of their lunar months is neither equal to twelve nor thirteen; they violate the definition of intercalary months so that the coupling between odd solar breaths and lunar months is broken. By analogy with the disorders of the Roman calendar – well-known for containing several years having a number of days in severe disagreement with the length of the solar year – such years could be called 'years of confusion'.[99] Still, the Chinese

---

[96]Chen Yongzheng 1991, p. 273.

[97]A. Arrault 2003, ibid. p. 104.

[98]D. Bodde 1975, p. 320: "In Ch'in the warding off was done by dismembering a dog at each of the four gates of the capital". See also the other remarks of the same author about the persistence of these sacrifices under the Han dynasty (p. 320) and the similarity between the Chinese and Western worlds of Roman times "In duration, season and association with heat, there are similarities between the three Chinese Fu [...] and the 'Dog days' of the Western world. The latter's dating, as far back as Roman times, was determined by the heliacal rising of the Dog Star Sirius" (p. 321). Hence a possible analogy with the Chinese case inasmuch as the Chinese character 伏 is composed of two disjoint parts, the first one, (right part) designating a dog 犬 and the other one, a man (left part).

[99]The Roman pre-Julian calendar also has numerous other irregular years (see P. Brind'Amour 1983, ch. 2, p. 27–123). For instance, the Roman year 708 AUC (*ab*

irregularities are quite different: the Roman aberrations were the consequence of a careless management of the calendar whereas the Chinese oddities were essentially provoked by political decisions, consisting in extravagant modifications of the beginnings and ends of certain years. Without going into too much detail we now provide their complete list and an overall description of their major characteristics:[100]

104 BC (Former Han, Taichu 1) This year contains 15 lunar months numbered $10, 11, 12, 1, 2, \ldots, 9, 10, 11, 12$. Beginning with a tenth month and finishing with a twelfth, it has two tenth, two eleventh and two twelfth months, respectively located at its beginning and end. Among its fifteen months, seven are full and eight hollow. Hence a total of 442 days ($7 \times 30 + 8 \times 29 = 442$). Despite this out of the ordinary number of days, none is intercalary even though its first tenth month would be an ideal candidate for such a qualification since it apparently contains no odd solar breath.[101]

8 (Former Han, Chushi 1) This year plainly contains twelve months (six full and six hollow) and 354 days. Contrary to all logic, however, it has an intercalary month, 1*, but no twelfth month, as a consequence of Wang Mang's decision to start the beginning of the year 9 with its twelfth month.[102]

23 AD (Xin (Wang Mang), Dihuang 4) With its 13 months and 384 days, this year does not seem particularly noteworthy but its two 12$^{\text{th}}$ months are not determined by any intercalation process and, contrary to what could be expected, its winter solstice does not belong to its 11$^{\text{th}}$ month but to its first twelfth month.

urbe condita), corresponding to 46 BC, was first dubbed *annus confusionis ultimus* (the final year of confusion) by the V$^{\text{th}}$ century philosopher and philologist Macrobius in his *Saturnalia* (P. Brind'Amour, ibid., p. 27). According to É. Biémont 2000, p. 225, this year contains 432 days and the preceding, 707 AUC, 378 days.

[100] The present list is slightly more complete than the one established by P. Hoang 1910/1968*, p. VII f., long ago. Further historical details of great interest are also given in E.P. Wilkinson 2012, p. 503–504.

[101] See Zhang Peiyu 1990*/1997*'s table.

[102] Wang Mang is the founder of the Xin dynasty, in 9 AD. See Wang Yuezhen 1867/1936*/1993*, *j.* 4, p. 12b–13a, 1936 edition (notice p. 378 below).

237 AD (Wei, Qinglong 5) No third month this time. Hence an unusually short year, containing eleven months (five full and six hollow) and only 324 days. However, its third month is missing and consequently, its last month is still the twelfth.

Next, the four years 689, 700, 761 and 762 AD have a number of days significantly lower or greater than a plain lunar year, oscillating between 295 and 444 days. The years 689 and 761 are wholly contained in the same Julian year while, on the contrary, the years 700 and 762 span three such years. The first two and the last ones respectively belong to the reign of the empress Wu Zetian (reign 684–704) and of the emperor Li Heng (reign 756–762). In these four cases, the calendar does not always respect the usual appellation of lunar months and violate the rule of insertion of intercalary months:

689 AD (Yongchang 1) This year is entirely contained in the year 689 (beginning: 27/1/689, end: 17/12/689). Its number of months is the same as that of the year 237 AD already mentioned above, eleven, but with six full months and five hollow months instead. Hence its $6 \times 30 + 5 \times 29 = 325$ days. Contrary to all logic, its intercalary month double its ninth month even though its number of lunar months is smaller than thirteen.

700 AD (Jiushi 1) Contrary to the preceding year, this one is composed of fifteen months, nine full and six hollow. Hence its 444 days ($9 \times 30 + 6 \times 29 = 444$). With such an exceptional length, this endless year begins on 27/11/699 and finishes on 12/2/701, thus extending over the three Julian years 699, 700 and 701. For once, its intercalary month, 7*, is not exceptional but the naming of its successive months is profoundly perturbed since each of its first three months seemingly correspond to a first month of the year: its first month, regularly called *zhengyue* 正月, follows the usual practice but, on the contrary, its second month, *layue* 臘月, refers to the month in which the Winter Sacrifice was held, the corresponding day being considered in Han times as another beginning of the lunar year.[103] Lastly, its third month is called

[103] D. Bodde 1975, ch. 3, p. 49: “Of the five annual beginnings listed in the preceding chapter, unquestionably that known as the *la* was, above all others, regarded by Han

yiyue 一月 'first month' since it contains the Beginning of Spring, another possibility referring to a plausible beginning of the solar year this time. Designed in this way, the year 700 thus has three successive first months. Consequently, its other lunar months are enumerated from its third month so that its last month is still the twelfth although it should be the fifteenth. (Table 2.11).

Months n°	Names		Meanings
1	*zhengyue*	正月	First Month
2	*layue*	臘月	Winter Sacrifice Month
3	*yiyue*	一月	First Month
4	*eryue*	二月	Second Month
.....			
9	*qiyue*	七月	Seventh Month
10	*run qiyue*	閏七月	seventh month
11	*bayue*	八月	Eight Month
.....			
14	*qiyue*	十一月	Eleventh Month
15	*qiyue*	十二月	Twelfth Month

Table 2.11. Anomalous month names (first year of the Jiushi era (700 AD)).

761 (Shangyuan 2) At the extreme opposite, this year has only 295 days ($5 \times 30 + 5 \times 29 = 295$). It begins on 10/2/761 and ends on 1/12/761 in the same Julian year. Less baroque than the two preceding years, save of course its unlikely length, this dwarf year has no intercalary month and its months are numbered regularly so that its last month is a tenth month and not a twelfth.

762 AD (Baoying 1) This year has 14 months and 413 days obtained from the combination of 7 full months and seven hollow months ($7 \times 30 + 7 \times 29 = 413$). The Julian dates of its first and last days, respectively correspond to the following dates: 2/12/761

Chinese as being *the* real New Year". To be sure, this Han feast has still been observed later. See, for instance, Li Yongkuang and Wang Xi 1995, p. 199 f.

and 18/1/763. Quite regularly too, this year has no intercalary month but its fourth and fifth months are doubled in a very original way: up to the fifth month, called ‘fifth month’, *wuyue*, the names of its months are regular but its two following months are respectively called *siyue*, fourth month and *wuyue*, fifth month, the succession of months in the corresponding part of the calendar being thus $4, 5, 4, 5$, and giving the illusion of going back in time to those who lived in China in 762. Once again, as in the case of the year 700 above, this new naming irregularity also induces surreptitiously the notion of an overall regularity, the last month of the year being always called ‘twelfth month’. To sum up the full enumeration of its months is the following: 1 (*zhengyue*), 2, 3, 4, 5, 4, 5 , 6, 7, 8, 9, 10, 11, 12.

http://www.springer.com/978-3-662-49717-3

Astronomy and Calendars – The Other Chinese Mathematics
104 BC - AD 1644
Martzloff, J.-C.
2016, XXXV, 471 p. 33 illus., Hardcover
ISBN: 978-3-662-49717-3