How did the 260 day ritual calendar arise?

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Abstract

We propose that there was a simple geometrcal origin for the 260 day ritual calendar in Meso-America

The ratio 365/260 is found in architectural features at both Stonehenge and Meso-America which clearly rules out any cultural (religious) influence, or latitude dependence for the choice of 260 since these cultures were separated by 9000 km, 2500 years, and over 30 degrees of latitude.

The construction of a square architectural layout at the very earliest stages of settlement, coupled with a count of 365 days in the year is sufficient to explain the choice of 260 days for the ritual calendar

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1. Introduction

Perhaps the earliest calendrical observation of all humans groupings was the variation of daily happenings. Despite the more obvious daily variations, early human societies must have recognized some repetitive elements of the world they experienced.

1. Sunrise happened regularly and defined what we call a day.

2. The moon waxed and waned over a period of several sunrises, our lunar month.

3. There was a repetitive seasonal variation period of several moon cycles, a solar year.

Once society had grasped the idea of counting (*did this arise after the adoption of a setlled residence?*), it soon became obvious that the number of days in a moon cycle (29 or 30) and the number of moon cycles (12 or 13) in a year varied a little. One could not rely on a count of moon cycles to define the start of a new year with new planting and harvest times.

Once settled in a village style, a count of days in a year could be estimated, provided obsevations were made over several years (*how were these records kept?*), and a 365 day calendar was sufficiently accurate to control planting or hunting schedules, at least over a few generations.

Clearly the gods must have ordained a 365 day cycle, *but why 365?*

365 is too long a period to be useful in regulating day-to-day activities. Is there a natural shorter period? Yes, there is; counting the shorter moon cycles is very easy and convenient, they are clearly marked by major events in the sky. But unfortunately moon cycles do not correlate at all well with the annual cycle.[i]

An important question would have been: *how many moon and solar cycles are required for the moon and solar calendars to agree on the same number of days?* It all depends on the accuracy you require:

1. A 19 year cycle: 19×365.2421934=6939.6016days; 235×29.53059=6939.6885days, an error of 0.001%.
2. A 334 year cycle: 334years=121990.89days; 4131months=121990.87days, an error of 0.000016%.
3. 4,418 year cycle: 4418years=1613639.984375days; 54643months=1613640.032505days, error 0.000003%
4. A 36,441 year cycle: 36441years=1352524.929688days; 796641months=2352524.926331days, an error of 0.0000001%.
5. Restricting the year to a whole number of days: 25×365.0=9125.0days; 309×29.53059=9124.95days
6. Approximating the lunar cycle to 29.5 days: 59×365.0=21535.0days; 730×29.5=21535.0days
7. The Meso-American solution: 52×365=18980days; 73×260=18980days

None of the first six examples above give any indication of a 260 day cycle: 365/260 is definitively not a solar-lunar solution to follow the progress of the year.

Other civilizations have used solar-lunar correlations to track time. Example 1 above was noted in 432 BC by the Greek astronomer Meton of Athens who showed that 19 years is very nearly equivalent to 235 lunar months. However, seven intercalary months (13 month years) were needed during the

[i]Many civilisations have tried moon cycles as a basis for an annual calendar, with strange results; Ramadan moves steadily around the seasons.

nineteen-year period (235 = 19×12 + 7). This 19 year cycle was known previous to Meton to Babylonian astronomers.

The 19 year Metonic cycle is sufficiently accurate (in error by 0.001%) to record time over a period on several generations, *but only provided that there is an established rule for the intercalary months*. In the Babylonian and Hebrew calendars, the years 3, 6, 8, 11, 14, 17, and 19 are the long (13-month) years. However the Metonic cycle is not an integral number of days. It requires much longer cycles to get close to an integral number of days.

The earliest settled Meso-Americans apparently did not recognize the Metonic cycle, or, perhaps more likely, they required an integral number of days for ritual purposes. Instead they chose a 260 day period composed of 13 numbered and 20 named days for their ritual calendar where 73 of these ritual periods corresponded to 52 solar years of 365 days. The advantage of rejecting the Metonic cycle and setting the length of the year to exactly 365 days[ii] is that is does of necessity generate a cycle of an integral number of days for any choice of a ritual cycle. *But again, why 260? when other numbers would serve equally well.*

The question of how the Meso-Americans came to choose 260 days for their ritual calendar has been considered (see Peeler and Winter) but without reaching any real consensus. We propose a very simple and very obvious reason for the choice.

A simple constructional observation coupled with a count of 365 days in the year is sufficient to explain the choice of 260 days for the ritual calendar. The explanation has the added recommendation that 260 can be regarded as the creator of 365, explaining why the gods should choose 365. In modern terms, the ratio 365/260 is close to the square root of 2 and arises naturally from a square in planar (Euclidean) geometry.

Suppose we start to layout a square area (for whatever purpose). We start from one corner and mark out the length of a side. Next we mark out a second side making a right angle with the first side. We now have two points, lets call them A and B, equidistant from our first point of origin. The ratio of AB to the side of our square is very close to 365/260. In fact it differs by only 0.73%. A square of side 260 has a diagonal differing from 365 by only 0.73%.

2. Conclusions

The observation of the ratio 365/260 at both Stonehenge ß (see Appendix) and in Meso-America clearly rules out any cultural (religious) influence, or latitude dependence for the choice of 260: these cultures were separated by 9000 km, 2500 years, and over 30 degrees of latitude.

[ii] The later Mayan long count clearly recognized that there were a little more than 365 days in the year, but the long count and the ritual calendar were inconsistent.

Any solar-lunar solution is impossible.

Once 260 has been built into a ritual calendar, its constructional origins could be forgotten and the ratio 365/260 ploughed back into architecture as seen at Stonehenge and as noted by Peeler and Winter in Monte Alban and Teotihuacan.

Table 1. Square root 2 Comparison

Root 2	**365/260**	**% diff**	**2*sin(2*π/8)**
1.4142	1.4038	0.733	1.4142
260*1.4142	260*1.4038		
367.6955	365.0000		

A. Appendix: Stonehenge

The earliest substantiated structure at Stonehenge, now known as Stonehenge 1, which has been dated to about 3100 BCE, was a circular bank and ditch about 110m in diameter, with a wide entrance to the north east, approximately oriented towards sunrise at the summer solstice, and with a narrower entrance on the opposite, south west, side.[i] Just within this ditch an almost perfect circle of the 56 equally spaced holes were dug, now known as the Aubrey Holes.[ii] In the period labelled Stonehenge 2, ca. 3000 BCE, more post holes appear to indicate a possible wooden structure within the circle, and a line of post holes from the south west entrance follow the line to the center of the circle. The next phase of construction, known as Stonehenge 3 I, ca. 2600BCE, is the one we examine in this paper.[iii]

This period, Stonehenge 3 I, ca. 2600 BCE, included a rectangle marked by a standing stone at each corner. The two shorter sides point closely to the midsummer sunrise in the period around 2500 BCE, and a lone stone (known as the Heel Stone, numbered 96) lying on an extension of the bisector of the rectangle points in the same direction. The four stones of the rectangle are known as the Station Stones, and are numbered 91-94. At midsummer the solstice sun rises along 92-91 and 93-94 and over the Heel Stone as viewed from the center of the rectangle, and the two summer full moons rise along either 93-92 and 94-91 or the diagonal 93-91. At midwinter the directions are reversed and the solstice sun sets along 91-92 and 94-93, and the midwinter full moons set along 91-94 and 92-93 or 91-93. The Station Stones lie very closely on the almost perfect circle of the 56 Aubrey Holes but it is clear which came first as the mound and ditch surrounding stone 92 are super-imposed on Aubrey holes 17, 18, and 19. These five stones we take as the primary stone

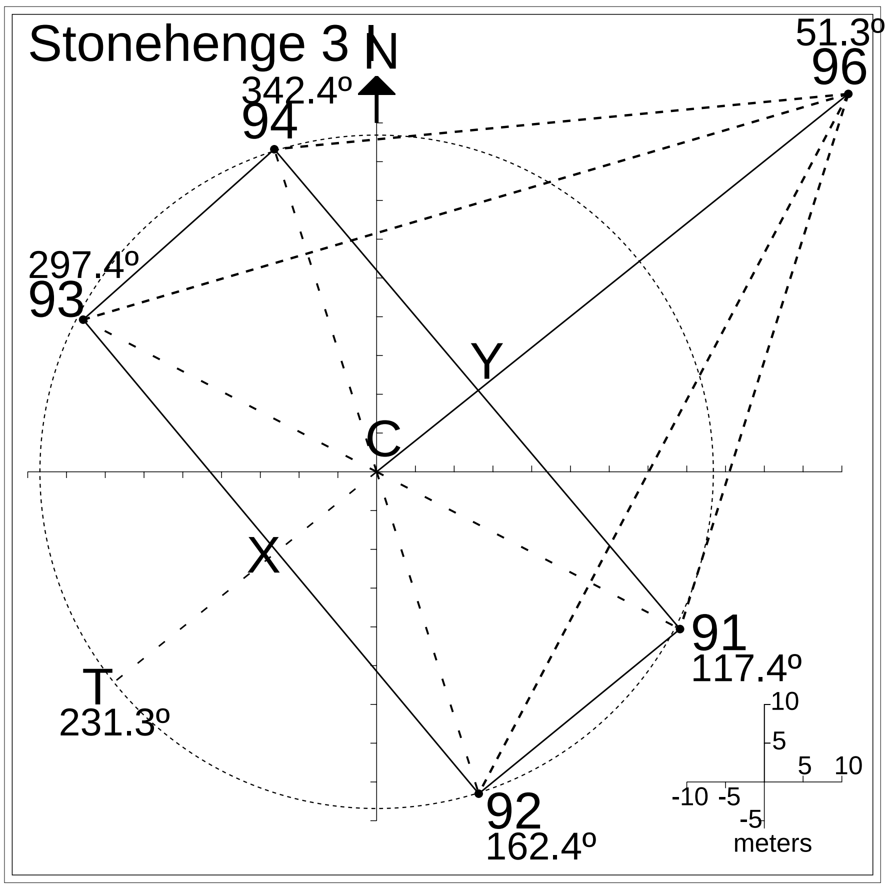
[i] It appears probable that even earlier post-holes dating back to perhaps 8000 BCE had held pine posts.

[ii] These holes were apparently dug and re-filled almost immediately with white chalk. Many of them were re-opened later to receive inhumations.

[iii] The strange nomenclature serves to include an older definition of periods when this was labelled simply Stonehenge I. The older nomenclature is often used in the work referenced in this paper

structure Figure A.1, “Basic Geometry of Stonehenge 3 I”, but we also include four major points along the primary axis; the intersection, *T*, of the main axis with the southern arc of the Aubrey circles (an important point defined earlier in Stonehenge 2.), the mid points of 91-94 (*X*), and 92-93 (*Y*), and the center, *C*, of the both the Aubrey circle and the Station Stones. This structure of Stonehenge 3 I clearly long pre-dated the other circles (such as the Y and Z holes), and the great trilithons and bluestone circle and horseshoe of Stonehenge 3 II, 3 IV, and 3 V.[iv] The geometry of this original structure is given in Figure A.1, “Basic Geometry of Stonehenge 3 I” below using the positions recorded on the plan issued by the Ministry of Public Building and Works in 1959.

Figure A.1. Basic Geometry of Stonehenge 3 I



References

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[iv]the original Stonehenge III has now disappeared and is subsumed in IV and V.

[WINTER10] Damon E Peeler and Marcus Winter. *Sun Above, Sun Below*. Astronomy, Calendar and Architecture at Monte Albán and Teotihuacan. First. . (November 2010). Centro INAH, Oaxaca, Arqueologia Oaxaqueña, Serie Popular. Pino Suárez 715, 68000 Oaxaca, Oaxaca, Mexico.

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