

On the Mayan Ethno-mathematics of Divination, *Debunking the Astronomical Decoding of the Mayan Tables*

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Abstract:

Saturno *et al.* (Reports, Science Vol. 336, p714-717) claim that the numeric tables found on the inner walls of a small masonry-vaulted structure in the extensive Mayan ruins of Xultun, Guatemala record the movement of the moon, and perhaps Mars and Venus, and tables in *Dresden Codex* are of the likeness. Here I show that those types of Mayan tables record mere divination readings and do not include nor imply any astronomical records.

Keywords: Maya, Mayan Codices, Mayan Calendar, Mayan Almanac, & Mayan Divination.

Main Text:

In 1561, the Spaniard burned hundreds of Mayan codices, calling them “the Devil's trickery” (1); and, in 1566, Bishop Diego de Landa wrote on its use in divination (2, 3). In 1904, Thomas wrote: “the Mayan calendar was used for astrological and divining proposes” (4). Recently, Saturno *et al* claim that Xultun’s tables and the like in *Dresden Codex* are astronomical records (5) despite Mayan codices lack descriptive geometry. The way that *Dresden* and *Madrid Codices* portray the Mayans wearing olive-shell or seed bandoliers; using male-gouts, sea-shells, and snakes (*Dresden*-p37) imply they are cult of diviners. Tedlock described the model divination of the Highland Maya, who use seeds and crystals (6). It is similar to Geomancy divination practice that Ascher analyzed its ethno-mathematics (7).

The mathematical idea of most divination practices is the same. The differences remain only in the used tools and the counting processes for identifying randomly the composite-numbers of the opening houses O_h , their features, their list of meanings, and their accommodation in the path of time. Using cowrie shells, if the number of shells that would be tossed twice is n , $O_h=n^2$, from A_1-B_1 to A_n-B_n ; where A or B is only the number of shells with mouth up. Using seeds, identifying $A-B$ in Geomancy of $O_h=16$, is by finding the remainders: 1 or 2, of four piles of random number of seeds, after keep subtracting 2 seeds from each pile, and the sequence of four remainders compose one house (7, 8). They repeat it to get four initial houses. Based on Tedlock's text (6), today's Maya count the number of subtracted-intervals of 4 seeds/crystals in each pile, and use it as the number of days elapsed from an index-day, e.g., day of divination, until reaching a house/day $A-B$ that meets the remainder. They also start with four houses.

The divination square-diagram of Geomancy is composed of distributing anticlockwise and clockwise the 16 houses, on its 4 sides, using the uniform interval 1 (9) or the rhythm: 8,4,8 (7); Al-Buni *et al* called it the circle of accommodation (9) for allocating the migrated houses. The inner-square of the diagram in *Madrid codex* pp75-76, is of similar organization and shows only the anticlockwise direction with spiral pyramidal sequence of B numbers, but it records key migrated numbers: e.g., 12 and 17, on 7 and 13 migration-intervals, see fig.1-a. Scholars explained that migration as scribal mistake (10). Al-Buni *et al* said that "each of the 16 O_h has four related houses on specific intervals, e.g., for 1, following the anticlockwise-series: 3 is its demand-evidence, 7 is its demand, and 6 is its left-witness; and following the clockwise-series, 10 is its right-witness" (9). The final reading is based on using ascending and descending series, form 1 to 16, in combination with the array of series of the related houses; and the features of meeting numbers in specific column(s) provide the diagnostic result. Similar arrays of series are found in *Dresden Codex*, using diverse intervals for A and B (vertical and horizontal), e.g., *Dresden*-p64. Table-1 shows the ascending and descending series that are shown in combined form in the table found in the east wall (5); were zero imply 20.

Each column in the table found in the north wall (5), and the like in *Dresden*-p24, is similar to the divination output record of the *Afro-Caribbean Santeria*; using 16 shells with $O_h=256$. Nuñez mentioned their complete list of meanings (11); some of them are proverbs, and might imply fortune, or misfortune that needs sacrifices. Based on what is explained by Lele (12), the diviners classified the features of numbers from 1 to 16 between: elder and younger.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	0	B
5	4	3	2	1	0	19	18	17	16	15	14	13	12	11	10	9	8	7	6	D ₁
17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	19	18	D ₂
12	6	0	14	8	2	16	10	4	18	12	6	0	14	8	2	16	10	4	18	E ₁
4	0	16	8	4	0	16	8	4	0	16	8	4	0	16	8	4	0	16	8	E ₂

Table-1: The corresponding series of migrated numbers, for the descending B values, from 20 to 1; the first array is formed by the series: B , D_1 and E_1 , and the second array is formed by the series: B , D_2 and E_2 . The used intervals are: 1 for the series: B , D_1 , and D_2 ; 6 for E_1 ; and the rhythm 8,4,4,4 for E_2 . The table found in the north wall (5) shows the readings for the B range from 13 to 1; e.g., values of B , B in row-1 are: 13; 12,12; 11,11; 10,10; ..; values of D_1 , D_2 in row-2 are: 5; 14,6; 15,7; 16,8;...; and values of E_1 , E_2 in row-3 are: 4; 6,8; 12,16; 18,0; ..; were 0 implies 20; i.e., any 20 equals zero only for the following term above 20.

They also use 8 catalytic tools, e.g., spiral-shell; four of them imply “yes” and the rest imply “no”. After identifying A - B , the diviner asks the client to hold secretly two of them, one in each hand, for getting a guiding reading C that answers yes or no for such question, via tossing the n shells only once and the numeric-feature of C directs the diviner to the answer hidden in either the left or the right hand of the client. The diviner can get therefore additional readings, from C_1 to C_4 or more, for diagnosing A - B . If any C gets zero, i.e., all mouths were down, it suspends the session for watering the shells, or closes it. The readings take the form $([A-B]:C_1, C_2, \dots, 0, \dots)$.

Madrid Codex shows signs of using seeds; and *Dresden Codex* shows signs of using shells. *Madrid*-pp77-78 show the lines of counting the intervals and remainders of seeds (2,3,&4) in black color, and series with the profile of *Erythrina* seeds in red color. Jars filled with the repeated glyph of 4 are shown in *Madrid*-pp34-37, implying the subtracted intervals. Using shells could be by tossing two sets: $n=13$ and $m=20$; thus, $O_h=(n*m)=260$, from A_1 - B_1 to A_{13} - B_{20} . In *Dresden Codex*, the shape of the olive-shell of mouth down was used to denote zero for the C readings, and with mouth-up to denote 20 or end of session, e.g., $([1-20]:3,13,0,\text{end}/20)$ in *Dresden*-p24, and in *Dresden*-p63&p70, see fig.1-b. In *Dresden*-p64, the catalytic spiral-shell of confirming answer is shown in the column of C readings, see fig.1-c.

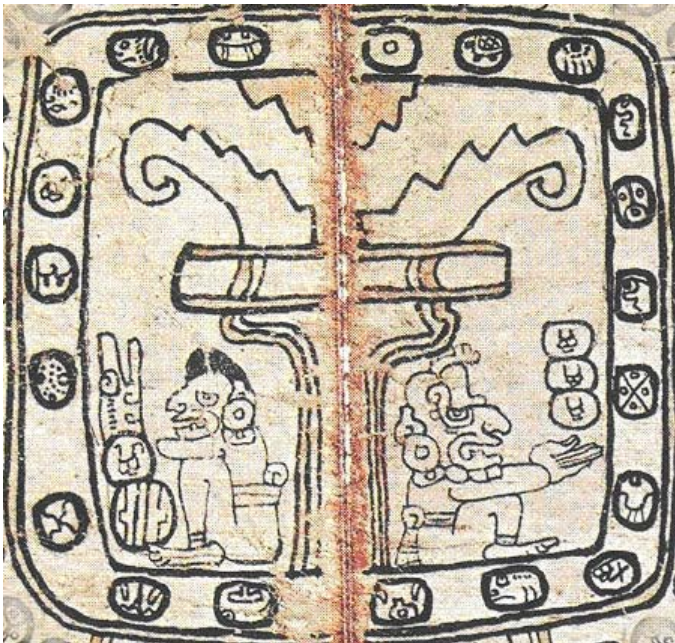
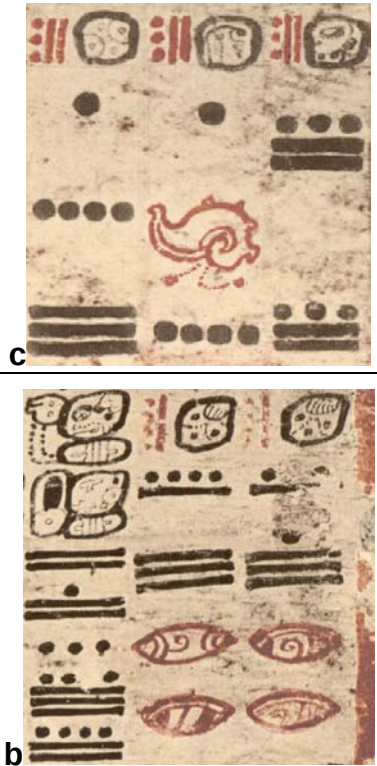
	12	13	9	5	1		
6							16
2							20
10							17
14							8
18							4
a	3	7	11	15	19		

Figure-1: The Divination Diagram and samples of divination tables: (a) The inner square of the diagram in *Madrid codex* pp75-76, where its set of 20 cluster numbers are written in Mayan Glyphs; (b) Two divination readings from *Dresden Codex* p-70: the right-side column includes two olive shells with mouth-up, which means 20, it should be read as ([9-14]:7,16,20,20/end), and the upper shell in the middle column has mouth-down which means zero, it should be read as ([9-14]:9,15,0,20/end); and (c) The use of the catalytic spiral shell of confirming answers in the columns of C readings, *Dresden Codex* p-64.

The Mayan codices include the list of meanings of some houses, where *A* and *B*, are recorded in red and black colors respectively. In tables glyphs were used to represent the *B* clusters. Despite the meanings of each *A-B* might vary from divination cult to another, the meanings of some Mayan *A-Bs* match that in the list of *Santeria* divination, see fig.2-a & 2-b. In the table in the north wall (5, 13), *A* readings are the sequence: 1,9,13,5 using the rhythm 8,4,8; and *B* readings seem the sequence: 19,4,12,7; using the rhythm: 5,8,5. The related houses/days from left to right are: [1-19], [9-4], [13-12], and [5-7]. Their *C* readings show migrated sequences; including 6 signs of mouth-up-shell that imply 20. The found tables and the like in *Dresden Codex* are only

divination records; multiplying its set-numbers by factors (14) is a misleading notion; and the found room is likely belongs to an ancient Mayan diviner.

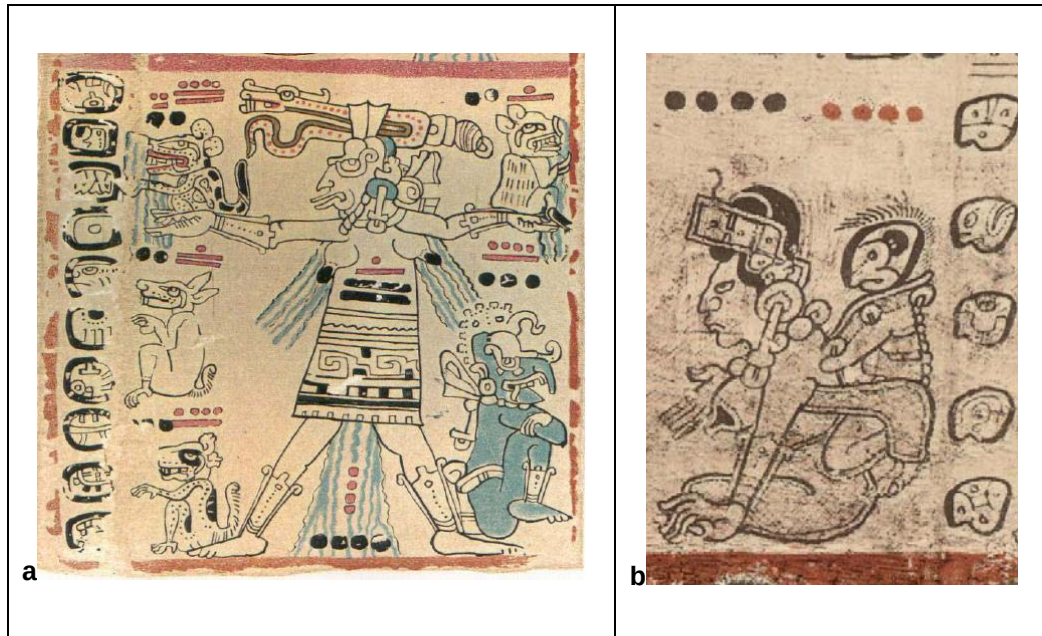


Figure-2: Examples of matching meanings of some A-Bs in Mayan codices with the list of *Santeria* divination (12), e.g., (a) shows caricature from page 30 in *Madrid Codex* (PL. XXVII) for the O_h [6-10] that its meaning in *Santeria* divination list is: “Two calves do not drink at the same fountain”; and (b) shows another caricature from page-18 in *Dresden Codex* for the O_h [4-4] that its meaning in *Santeria* divination list is: “The son that was born strong, healthy and straight is now crooked from lack of care”.

References and Notes:

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6. Tedlock, Barbara, *Time and the Highland Maya*, University of New Mexico Press, Albuquerque, 1982, pp153-170.
7. Ascher, Marcia, Malagasy Sikidy: A Case in Ethnomathematics, *Historia Mathematica* 24 (1997), 376–395, Article No. Hm972159.
8. The oldest known source of Geomancy (the science of Sand) is Idris, the Egyptian priest; its early practice was by writing on sand, using dashes and dots (9); and the shapes of its 16 O_h were like the I Ching symbols; today, two seeds represent dash and one seed represents a dot.
9. Al-Buni, Ahmad, "Sun of the Great Knowledge and Simple Explanations" (*Shams al-ma'arif al-kubra wa laṭa'if al-awarif*), Appendix-1: "Letter on the Fair Measurement for the Meanings of the Judgments of Sand" (*Risalah Mizan al-adl fi maqāṣid aḥkam al-raml*), by Abdulkader Al-Hussieny Al-Adhamy, 1226G-622H, pp545-560 (Copy in Columbia University Libraries. New York, NY 10027 USA).
10. Paxton, Merideth, *Cosmos of the Yucatec Maya Cycles and Steps from Madrid Codex*, University of New Mexico Press, 2001, p33.
11. Lele, Ócha'Ni, *The Diloggún: The Orishas, Proverbs, Sacrifices, and Prohibitions of Cuban*, chapter-1 on the oracle of the Orishas, Destiny Books, Vermont, 2003, p9-41.
12. Nuñez, Luis M., *Santería: A Practical Guide to Afro-Caribbean Magic*, Spring Publication, 1992, pp90-110.
13. From the left-side, $A-B$ of the first two houses, A of the third, and B of the fourth are confirmed by Saturno *et al* (5), and C_1 for the house/day [13-12] is 12 and not 17 as suggested by Saturno *et al*.
14. The factors: 20, 360, 7200, 144000, etc. are inventions by some modern scholars and have no hard evidence in the Mayan architectural heritage nor in the Mayan codices.