Babylonian House Numbers and Squares of Zodiacal Signs

The Origin of the Quadruplicities, Part I

by

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Abstract

BM 47762 is the rest of a circular tablet, which was divided into 12 sectors by lines from the center to the rim. Each sector was labelled by a zodiacal sign. Our tablet consists in part of the sectors IX, X, XI, and XII, which are concerned with the zodiacal signs of Sagittarius (month IX), Capricorn (month X), Aquarius (month XI), and Pisces (month XII). In lines 2 to 5 of each sector, some four numbers are written, which in pairs can be understood as a date (month, day) or as a position (sign, degree)—just as in the *Dodecatemoria* and its inverse, the Calendar Texts (*Kalendertexte*). The combination of number pairs on BM 47762 do not appear in those schemes. However, the difference between the pairs in lines 3, 4, and 5 is always equal to 277, a very special number which is known from the Calendar Texts. Evidently, our number pairs must somehow be connected to those number schemes.

This paper investigates and finds a very interesting connection. It shows that all number pairs stand for dates, for which the *Dodecatemoria* scheme will give the position of the schematic Moon in its four important phases. The second number pairs refer to the months of the section, while the first pairs give the dates of the four important lunar phases three months earlier. The two dates on each line correspond to lunar positions taking place at almost the same position in the zodiac. The zodiacal signs of the lunar phases on days 7, 14, 21, and 28 join to squares which are mostly known from Greek astrology. For example, for month XI, the signs of the Moon have the numbers 2, 5, 8, and 11, i.e., the zodiacal square with 11 as one of the corners. Maybe we here have found the origin of the quadruplicities of the zodiacal signs.

About the Author

LIS BRACK-BERNSEN'S research is in the history of mathematics and astronomy, especially the development of Babylonian astronomy and the use of computer simulations of ancient Babylonian observational data in systematic analyses. Her aim is to reconstruct the ancient rules governing prediction and to discover the concepts and methods behind early Babylonian astronomy.

Wayne Horowitz and John Steele [2017, 225–232] have described and translated this interesting table, noting its eventual connection to the *Dodecatemoria* and Calendar Text schemes, and inviting others to offer a fuller explanation of the text and its place in the cuneiform astronomical/astrological corpus. They noticed that we have sets of four numbers here—as in the *Dodecatemoria* and Calendar Texts schemes. The numbers have the same range as in those schemes: the first and third numbers are one of 1, 2,...12, while the second and fourth numbers can take values between 1 and 30. Therefore, we may arrange them into number pairs. In line 3 of Plate 1 [p. 46], e.g., we thus read 12 7 9 14 as the pairs (12 7) and (9 14), which indicate (month and day) or (zodiacal sign and degree) or both. But the combinations of number pairs that we find on this tablet do *not* occur in the *Dodecatemoria* and Calendar Texts schemes. However, for each of the 12 pairs within the red rectangle in Plate 1, the difference between the first and second pair is equal to 277, a number known from the Calendar Texts. To give an example, when we read (12 7) and (9 14) as positions (or dates), the distance from the first to the second is 277° (or 277 days), respectively. The occurrence of this very special number, 277, indicates that there must be a connection to the Calendar Texts—and/or to its inverse, the *Dodecatemoria* scheme.[1]

This paper elucidates the connection between BM 47762 and the number schemes, and the consequences thereof. As Horowitz and Steele conjectured, and as we shall see, there may also be a connection to the phases of the Moon. Since all sectors of BM 47662 have the same structure, I shall concentrate on the third sector, designated as sector XI [see Plate 1]. It lists in the second line the numbers: 2 28 11 7. The pair (2 28) is, however, never listed next to (11 7) in the known schemes. Let us assume that each number pair (indicating a date or a position or both) is the first part of the Calendar Text or of the *Dodecatemoria* scheme. But which one? To which "partner" do the pairs

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[1] For a detailed analysis of the *Dodecatemoria* and Calendar Text schemes, their mutual connection, and a clarification of their astronomical significance, see Brack-Bernsen 2021. See also Brack-Bernsen and Steele 2004.

	Sector IX	Sector X	Sector XI	Sector XII
(1)	[Sagittarius 11 28]	[Capricorn 12 28]	Aquarius 1 28	[Pisces 2 28]
(2)	[12 28 9 7]	[1 28 10 7]	2 28 11 7	3 [28 12 7]
(3)	[12 7 9 14]	[1] 7 10 14	2 7 11 14	3 7 1[2 14]
(4)	[12 14 9] 21	1 14 10 21	2 14 11 21	3 14 1[2 21]
(5)	[12 21 9 2]8	1 21 10 28	2 21 11 28	3 21 12 [28]
(6), (6a)	[9 21 beginning of Virgo]	10 21 beginning of Libra	11 21 beginning of Scorpio	12 21 begin[ning] of Sagitt[arius¹]
(7)	[28 [...]]	28 The She Goat	28 [...] The Kidney	28 Šulpae
(8)	[7 in front of [...]]	[7 in front of] Jaw of the Bull	7 in front of The Kidney	7 [in front of [...]]

Plate 1.   Partial reconstruction of BM 47762
[Horowitz and Steele 2017, 228]

belong? In order to find out, in Table 1 [p. 47] I have added to each pair its
partner according to the two schemes: the red partner is the one from the
Dodecatemoria scheme, while the blue one is that according to the Calendar
Text scheme. From the numbers 2 28 11 7 in line 2 of Plate 1, we get the
quadruples: (2 28 2 4) or (2 28, 8 16), and (11 7, 2 1) or (11 7 3 19) [see lines
2–3 of Table 1, p. 47 below].

In the same way, all number pairs from lines 2 to 5 of sector XI in Plate 1 are
complemented by their partners from the two schemes in Table 1. Section
XI starts with Aquarius, followed by the pairs of numbers given in columns
1, 2 and 6, 7.

The Calendar Text quadruples in blue do not seem to connect to each other in
any way, whereas the red numbers connect nicely with each other, yielding
a systematic pattern. Thus, it makes sense to complement the given number
pairs by their partners from the *Dodecatemoria* scheme, for which we know
that the first pair indicates a date and the second pair indicates the schematic
position of the Moon on that day. Thus, we conclude that the first pairs
(in columns 1, 2 and 6, 7) indicate schematic dates, while the added red
number pairs (in columns 3, 4 and 8, 9) indicate the lunar positions on these

1	2	3	4		6	7	8	9
2	28	2	4		11	7	2	1
2	28	8	16		11	7	3	19
2	7	5	1		11	14	5	2
2	7	6	19		11	14	8	8
2	14	8	2		11	21	8	3
2	14	11	8		11	21	12	27
2	21	11	3		11	28	11	4
2	21	3	27		11	28	3	16

Table 1.

The number pairs in columns 1, 2 and 6, 7, respectively, are complemented into quadruples from the *Dodecatemoria* in the red upper cells, and to Calendar Text quadruples in the lower blue cells. Note that the first line after the number columns in Plate 1 has: "11 21 Beginning of Scorpio", a remark which fits the addition of "8 3" to "11 21" in line 6 of this table.

dates. The correctness of this addition is supported by the position (8 3) after date (11 21) in the scheme. The number set (8 3) stands for Scorpio 3, which is at the beginning of Scorpio, in agreement with the remark "11 21 beginning of Scorpio", which is written further down in section XI [see Plate 1]. Now it becomes clear that the original number pairs (those written on the tablet) must refer to the *Dodecatemoria*. In Table 2 [p. 48], I shall present the reconstructed quadruples in the same format as we know from the *Dodecatemoria* scheme: the first number set indicates a date, and the second (added) number set indicates the corresponding schematic position of the Moon. There are so many connections that I am sure that we have found the reason (or at least part of it) behind sector XI.

Additional support for the identification of all number pairs from section XI as dates is that these dates are given in steps of seven days and are, therefore, presumably concerned with lunar phases. It is astronomically relevant to consider dates that are seven days apart. I see the dates 7th, 14th, 21st, and 28th as referring to lunar phases: first half, full Moon, second half, and black Moon. I know that this is not fully consistent with the schemes from tablet 14

Month	Day	Sign	Degree		month	day	sign	degree
2	28	♉ = 2	4	Taurus	11	7	♉ = 2	1
2	7	♌ = 5	1	Leo	11	14	♌ = 5	2
2	14	♏ = 8	2	Scorpio	11	21	♏ = 8	3
2	21	♒ = 11	3	Aquarius	11	28	♒ = 11	4

Table 2.

The dates given in section XI (in dark red) together with the schematic lunar positions as found in the *Dodecatemoria* scheme. Note that in each line, the two lunar positions are very close to each other. This is not just a coincidence—it must have been intended.

of *Enūma Anu Enlil*[2] and MUL.APIN,[3] where the full Moon is listed on day 15 of each month. But in any case, the days 7, 14, 21, and 28 in a Babylonian month are very close to the important lunar phases: first half, full Moon, second half, and invisible/black Moon. So I shall read them as such.

I use the nonastronomical term "black Moon" for the lunar phase on day 28 intentionally: I understand it as the first day on which the schematic Moon is invisible, but it is not the day of the conjunction with the Sun. That the Babylonians were indeed concerned with the first and second half Moon is documented in the text BM 42282+42294, where different methods for finding the duration of the month (30 or 29 days) are recorded in different sections separated by lines. The first section on the reverse of this tablet, Section 1′, uses the date when the first half Moon culminates at sunset to determine the months' length. Section 2′ determines the months' lengths through the day at which the Moon (in its second half-phase) culminates at sunrise [Brack-Bernsen and Hunger 2008, 18–19].

Note that in Table 2 the full Moon in month 11 is just 1° away from the position of the first half Moon in month 2. Similarly, the position of the second half Moon in month 11 almost gives us the position of the full Moon in month 2, the position of the black Moon in month 11 almost indicates the position of the second half Moon in month 2, and the position of the

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[2] This tablet is the 14th in a series of astrological/astronomical tablets. See Al-Rawi and George 1991.

[3] MUL.APIN is a Babylonian astronomical compendium consisting of two cuneiform tablets. See Hunger and Pingree 1989 or Hunger and Steele 2019.

first half Moon in month 11 is only 3° off the position of the black Moon in month 2.

It seems, then, as though our tablet BM 47762 is connecting lunar phases that take place at almost the same position in the sky (according to the *Dodecatemoria*'s scheme of mean value). Or, put another way, the pairs of numbers given in the text must be understood as dates, chosen such that the Moon is in one of its four special phases on those dates. In addition, the dates of each section are paired in a special way: the dates, written next to each other in lines 3, 4, and 5 within the red rectangle in Plate 1 correspond to lunar positions that are only 1° apart.

Now we also understand the occurrence of the number 277. A Calendar Text lists in the two generating columns consecutive positions (1°, 2°, ...30°) of the Moon within a sign *S*, while the dates at which the Moon was in the listed position are written in the two dependent columns [see p. 45 note 1 above]. After 277 days, the Moon's position has increased by 1° according to the *Dodecatemoria*, which calculates the movement of the Moon as being 13°/day. After 277 days, the Moon has moved

$$13° \times 277 = 3601° = 1°(\mathrm{mod}\ 360).$$

Note that the zodiacal signs, in which the four lunar phases in months XI and II take place, are Taurus, Leo, Scorpio, and Aquarius. They build one of the three quadruples (the "fixed" quadruplicity), which is known from Greek astrology [Rumor 2021, 60, 63].

Do we just find astrological connections here? Jeanette Fincke has been working, too, on this tablet. Our ideas and investigations are, however, different and completely independent of each other.[4]

In our circular tablet BM 47762, we have found a connection of lunar phases taking place in the same part of the zodiac. Let me illustrate this connection

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[4] Just after I had presented this understanding of the text in Jerusalem in 2018, Jeanette Fincke reminded me of a talk that she had given in Berlin at the fourth "Regensburg workshop" in 2014, in which she presented this circular tablet together with another part (to which I have no access), and kindly sent me her comments on that talk. In the talk, she referred to stars and constellations mentioned in the text, and proposed that we here have a connection to rising arcs, zodiacal signs, and micro-signs. Her identification of the number pairs and her explanation is different from mine. She reads one number pair as date and the other as position, in spite of the fact that the combination of numbers cannot be found in the *Dodecatemoria*, whereas I read both number pairs as dates. I had completely forgotten her talk when I received the edition of BM 47762 from Horowitz and Steele in my Festschrift [see Steele and Ossendrijver 2017], in which I was encouraged to enjoy their exposition of the

Lunar phase	Month	Day	Lunar position	Month	Day	Lunar position	Lunar phase
Black ●	II	28	♉ 4°	XI	7	♉ 1°	1st half ◑
1st half ◑	II	7	♌ 1°		14	♌ 2°	Full ○
Full ○	II	14	♏ 2°	XI	21	♏ 3°	2nd half ◑
2nd half ◑	II	21	♉ 3°	XI	28	♉ 4°	Black ●
				XI	21	beginning of Scorpio	
					28	the Kidney	
					7	in front of the Kidney	

Table 3.

The dates given in section XI together with the schematic lunar positions, found according to the *Dodecatemoria* scheme.

between dates and lunar phases: when the number pairs are identified as dates (month and day), the four lunar phases that take place in the beginning of one zodiacal sign, e.g., Aquarius, are connected in a structure like the following:

	☾	☾	☾	☾
	Phase, Position	Phase, Position	Phase, Position	Phase, Position
Event	1st half, ♒ 1°	Full Moon, ♒ 2°	2nd half, ♒ 3°	Black, ♒ 4°
Date	month VIII day 7	month V day 14	month II day 21	month XI day 28

Table 4.

The last two boxes present my interpretation of the numbers 2 21 11 28 from sector XI, line 5, of Plate 1 [p. 46]. Our circular tablet has traces from the sectors IX, X, XI, and XII. Below I have reconstructed the complete numerical scheme for all 12 zodiacal signs. The reconstruction is based on the numbers given in lines 2–5 of Plate 1. Each section starts with a zodiacal sign, that is, the sign corresponding to the number or month of

"mathemagical" text and, by building on their analysis, to provide a fuller explanation of the text and its place in the cuneiform astronomical-astrological corpus. That is what I am trying to do here.

the section, e.g., XI → ♒. The original lines 6, 7, and 8 are left out in this scheme. But in those three sectors (X, XI, XII) where line 6 is preserved, we find confirmation of the reconstructed position on day 21 in the three months, X, XI, and XII, which is 3° in signs 7, 8, and 9. In the text we read, "beginning of Libra, Scorpio, and Sagittarius", respectively.

Sector X								Sector XI								Sector XII							
1	28	1	4	10	7	1	1	2	28	2	4	11	7	2	1	3	28	3	4	12	7	3	1
1	7	4	1	10	14	4	2	2	7	5	1	11	14	5	2	3	7	6	1	12	14	6	2
1	14	7	2	10	21	7	3	2	14	8	2	11	21	8	3	3	14	9	2	12	21	9	3
1	21	10	3	10	28	10	4	2	21	11	3	11	28	11	4	3	21	12	3	12	28	12	4

Sector I								Sector II								Sector III							
4	28	4	4	1	7	4	1	5	28	5	4	2	7	5	1	6	28	6	4	3	7	6	1
4	7	7	1	1	14	7	2	5	7	8	1	2	14	8	2	6	7	9	1	3	14	9	2
4	14	10	2	1	21	10	3	5	14	11	2	2	21	11	3	6	14	12	2	3	21	12	3
4	21	1	3	1	28	1	4	5	21	2	3	2	28	2	4	6	21	3	3	3	28	3	4

Sector IV								Sector V								Sector VI							
7	28	7	4	4	7	7	1	8	28	8	4	5	7	8	1	9	28	9	4	6	7	9	1
7	7	10	1	4	14	10	2	8	7	11	1	5	14	11	2	9	7	12	1	6	14	12	2
7	14	1	2	4	21	1	3	8	14	2	2	5	21	2	3	9	14	3	2	6	21	3	3
7	21	4	3	4	28	4	4	8	21	5	3	5	28	5	4	9	21	6	3	6	28	6	4

Sector VII								Sector VIII								Sector IX							
10	28	10	4	7	7	10	1	11	28	11	4	8	7	11	1	12	28	12	4	9	7	12	1
10	7	1	1	7	14	1	2	11	7	2	1	8	14	2	2	12	7	3	1	9	14	3	2
10	14	4	2	7	21	4	3	11	14	5	2	8	21	5	3	12	14	6	2	9	21	6	3
10	21	7	3	7	28	7	4	11	21	8	3	8	28	8	4	12	21	9	3	9	28	9	4

Table 5.   Reconstruction of all 12 sections of the number sets on the circular tablet BM 47762, together with their values according to the *Dodecatemoria* scheme

The dark red numbers are those from the tablet, indicating special dates, while the other numbers are the lunar position on those dates. Each sector is now subdivided into two blocks of four columns with four lines each. Fincke reads the last date in sector III as 3 18 on the extra segment that she found. I see it as a writing error and have replaced it with "3 28".

In Table 5, the pairs of numbers, given on BM 47762, are taken apart through the addition of the second, black pairs. We can identify the pairs: the first (dark red) pair indicates a date, and the second (supplemented black) pair indicates the position of the schematic Moon on that date, i.e., sign and degree, in which the four lunar phases (Black Moon, 1st half, full Moon, 2nd half) took place according to the *Dodecatemoria* scheme. Note that these schematic lunar positions all take place within the first four degrees of each zodiacal sign. Therefore, let us ignore for a moment the degrees and concentrate on the zodiacal signs.

The first dark red number (in each number square) indicates a month, which at the same time is the zodiacal sign of the schematic Sun, while the first black number indicates the sign of the Moon. The interpretation of each block (of 4×4 numbers) is in all cases the same: in the first column we find the same sign four times, which is the sign (= month) of the Sun during which the four special lunar phases in that month took place. The first column of each block, therefore, may indicate a zodiacal sign, while the four numbers in column 3 list the signs of the important Moon phases taking place in that month.

In Babylonian astrology, zodiacal signs are often joined to triplets that form a triangle within the zodiacal circle. Here we have signs that form squares: the numbers in the four lines of column 3 of each block indicate four zodiacal signs. By connecting the middle of each sign to the middle of the next in the sequence, we get a square. The signs in column 3 can also be regarded as the micro-signs of the four Moon phases within the sign indicated in column 1.[5] Note that the signs and the corresponding micro-signs always belong to one and the same sign square (1, 4, 7, 10), (2, 5, 8, 11), or (3, 6, 9, 12). A similar structure can be found in some strange schemes, which I shall call "expanded Calendar Text" schemes [Steele 2015, 203, 209–210]. Such an expanded Calendar Text scheme starts with number quadruples (a, b, c, d), known from the Calendar Texts, and continues with additional numbers e, f, g, h, i, j, whereby each line of the scheme ends with the words "i of house j".

John Steele [2015, 210] has proposed that we read the numbers i as micro-signs of (the house) j. Two such texts are known, and in both cases the house number j was the same in four consecutive lines, while the numbers

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[5] The connection between the *Dodecatemoria* and micro-signs is well known. For a visual representation and further explanations, see Brack-Bernsen 2021.

i in these lines consist of the four signs from the same square as *j*. If Steele's proposal is correct, we have here again a zodiacal sign *j*, which is called the "house", of four *i*-values indicating the four micro-signs of the square defined by *j*.

Maddalena Rumor [2021, 59–63] has also analyzed the expanded Calendar Texts. Quoting Pliny the Elder and Sextus Empiricus, she has shown that the Babylonian Calendar Texts system was used to determine remedies for ointment in the treatment of fevers and that the three types of squares consisting of four zodiacal signs each—the tropical, the bicorporal, and the fixed quadruplicities (as they are called by Ptolemy)—originate from Mesopotamia [2021, 52–57, 70]. Her proposal that «E′», the "house" term, refers to quadruplicities seems very convincing.

Independently, I had also investigated the expanded Calendar Texts and found that they, through the numbers *i* and *j*, are structured by the same sign squares, (1, 4, 7, 10), (2, 5, 8, 11), or (3, 6, 9, 12), as those found on our reconstructed circular tablet. An eventual connection between the two systems shall be investigated in part 2 of this paper,[6] which also presents a reconstruction of how the expanded Calendar Texts determined the house numbers with the corresponding micro-signs *i*.

Let us return to BM 47762 and recapitulate. When we determine the position of the schematic Moon on the days 7, 14, 21, and 28 according to the *Dodecatemoria*, for each month we get zodiacal signs forming a square. The text led to three sign squares (1, 4, 7, 10), (2, 5, 8, 11), and (3, 6, 9, 12), which are well known in astrology. Rumor tells me that Geminus (first century BC) writes that the square starting from Aries is "called the first square", the one starting from Taurus is "called the second square", and that "called the third square is the one starting with Gemini" [Geminus, *Intro. ast.* 2.17].[7]

Geminus' introduction supports the interpretation of BM 47762. In Table 5 [p. 51] for sector I → Aries, the second block is concerned with month I, where the Sun is in Aries, while the Moon on the days 7, 14, 21, and 28 will be situated in the signs 4, 7, 10, and 1, respectively. This is called the "first square" by Geminus. Similarly, the second and third squares can be found in the sectors II and III beginning with the signs 2 and 3, respectively. For all 12 months, we have a similar structure: in line 1, each section indicates the zodiacal sign of the Sun during the corresponding month together with

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[6] To appear in *Aestimatio* 3.1.

[7] I am very grateful to M. Rumor for this reference.

Sign	Mon.	Day	Mon.	Day	Sign	Sign	Mon.	Day	Mon.	Day	Sign	Sign	Mon.	Day	Mon.	Day	Sign
		Sector X ♑						Sector XI ♒						Sector XII ♓			
I	1	28	10	7	I		II	2	28	11	7	II	III	3	28	12	7	III
IV	1	7	10	14	IV		V	2	7	11	14	V	VI	3	7	12	14	VI
VII	1	14	10	21	VII		VIII	2	14	11	21	VIII	IX	3	14	12	21	IX
X	1	21	10	28	X		XI	2	21	11	28	XI	XII	3	21	12	28	XII
		Sector I ♈						Sector II ♉						Sector III ♊			
IV	4	28	1	7	IV		V	5	28	2	7	V	VI	6	28	3	7	VI
VII	4	7	1	14	VII		VIII	5	7	2	14	VIII	IX	6	7	3	14	IX
X	4	14	1	21	X		XI	5	14	2	21	XI	XII	6	14	3	21	XII
I	4	21	1	28	I		II	5	21	2	28	II	III	6	21	3	28	III
		Sector IV ♋						Sector V ♌						Sector VI ♍			
VII	7	28	4	7	VII		VIII	8	28	5	7	VIII	IX	9	28	6	7	IX
X	7	7	4	14	X		XI	8	7	5	14	XI	XII	9	7	6	14	XII
I	7	14	4	21	I		II	8	14	5	21	II	III	9	14	6	21	III
IV	7	21	4	28	IV		V	8	21	5	28	V	VI	9	21	6	28	VI
		Sector VII ♎						Sector VIII ♏						Sector IX ♐			
X	10	28	7	7	X		XI	11	28	8	7	XI	XII	12	28	9	7	XII
I	10	7	7	14	I		II	11	7	8	14	II	III	12	7	9	14	III
IV	10	14	7	21	IV		V	11	14	8	21	V	VI	12	14	9	21	VI
VII	10	21	7	28	VII		VIII	11	21	8	28	VIII	IX	12	21	9	28	IX

Table 6.   Reconstruction of the numerical part of
the original circular tablet BM 47762 in its entirety

The four lines with quadruple numbers from the sectors X, XI,
and XII are almost intact and clearly reveal the system behind
the numbers. The missing sections have been reconstructed ac-
cording to this system. The (reconstructed) number pairs, which
we interpret as dates, are printed in dark red. They list a month
together with the days (7th, 14th, 21st, and 28th) of the four spe-
cial lunar phases in that month. The signs of the Moon on those
dates are given through roman numbers. In addition, the first line
of each section has been reconstructed. It lists that zodiacal sign
which corresponds to the month (= the first number) of the sec-
ond number pair. It is the zodiacal sign through which the Sun
passes during the month in question. The four signs of the Moon
on the days 7, 14, 21, and 28 in that month constitute the zodi-
acal square of signs, ending with the sign of the section. Sector
VII, e.g., is concerned with Libra = sign VII → month VII. In four
lines, month number 7 is given together with the days 7, 14, 21,
and 28. The signs of the Moon on those days are: X, I, IV, VII, and
they define a square in the zodiacal circle.

the four signs of the Moon in its important phases on days 7, 14, 21, and 28. In all months, the signs of the Moon deliver the square of the month in question.[8] Accordingly, I postulate that we have found the origin of the squares in Babylonian astrology. As evidence, we have the circular tablet BM 47762 with pairs of numbers, all of which can be interpreted as dates of the important lunar phases; these dates are connected in a very special way, namely, such that all pairs of dates (which are written next to each other on the tablet) refer to special lunar phases taking place very close to each other— in the same zodiacal sign and within only one to three degrees distance.

In Table 6 [p. 54], I have reproduced the reconstructed data in a different way. The pairs of dates, given on the whole and reconstructed Table BM 47762, are now written next to each other and printed in dark red. The zodiacal signs of the Moon on those dates are given through roman numbers and written before the first date and behind the second date. For each of the two dates, given in one line of a sector, the corresponding zodiacal sign is always the same.

I have not yet found any theoretical consistent explanation for the connection between BM 47762 and the expanded Calendar Text schemes. But since the Calendar Text scheme is the inverse of the *Dodecatemoria* scheme, I see some problems for finding rational or astronomical arguments behind it— especially since the number i is not always equal to c, which indicates the sign in which the Sun is situated (according to the Calendar Text). However, the squares consisting of the numbers i for each house number j are exactly the same as the micro-signs found in the *Dodecatemoria*-based system, albeit with a different order in the sequence of micro-signs. Maybe the square system was just taken over as an organizing system.

Table 7 illustrates the connection between the circular tablet and the expanded Calendar Texts. Column 1 shows the dates from section XI on the circular tablet BM 47762, while column 2 indicates the sign of the Moon on those dates. The last six columns summarize the expanded Calendar Text schemes. Column 3 gives consecutive positions of the Moon (in sign 2!), and column 4 lists the dates at which the Moon occupied those positions. Column 5 reproduces the house number 11 according to the scheme, and

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[8] These squares of signs are similar to those listed in the expanded Calendar Texts. But there the system was not derived directly from the numbers in the Calendar Texts; some other and stronger organizing principles seem to reign. Maybe the structure from BM 47762, which was based directly on the *Dodecatemoria,* was transferred to the Calendar Texts.

			Column				
1	2	3	4	5	6	7	8
Sector XI Sign 11	Sign of the Moon	*Expanded* a b	Calendar Texts c d	j	"micro-sign" i	Sign of the Moon	Sign of the Sun
Month 11 day 7	2	2 11	7 17	11	8	2	7
Month 11 day 14	5	2 12	4 24	11	5	2	4
Month 11 day 21	8	2 13	2 1	11	2	2	2
Month 11 day 28	11	2 14	11 8	11	11	2	11

Table 7. The Moon sign system (left), constructed on the basis of the dates from BM 47762, compared with the house number system found on tablet BM 36303 +

In this expanded Calendar Text, the c numbers differ from the micro-sign numbers i in the two first lines. The numbers j and i are not determined directly by the numbers c.

column 6 renders the numbers of i, which together with 11 form a zodiacal square. In columns 7 and 8, the signs of the Moon and the Sun, as given in columns 3 and 4, respectively, have been added. Apparently, the Sun again determines the house number 11. In a second paper, "Babylonian House Numbers and Squares of Zodiacal Signs: Origin of the Quadruplicities, Part II", an investigation of the expanded Calendar Texts will appear in *Aestimatio* 3.1 (2022).

Conclusion

We have seen how the dates given on the circular tablet BM 47762 lead to the squares for each zodiacal sign. This system is consistent, and it may show us how the quadruplicities of zodiacal signs were constructed in Mesopotamia. The *Dodecatemoria* mean value scheme for lunar movement, when used to determine the position of the Moon on the schematic days 7, 14, 21, and 28, leads directly to the quadruplicities of zodiacal signs. We have also seen that there is a close connection to the expanded Calendar Text schemes. However, a rational explanation for how the expanded Calendar Text schemes were derived from the *Dodecatemoria*-based quadruplicities escapes me at the moment.

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