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'Akzent' 8

## Levi's Secret – Sidereal Moon Astronomy

***"Time sure flies. It's already past twelve."***

One move and one new job further, here I write again, possibly my last contribution to the realm of biblical number interpretation. I simply do not have the time and energy any more to go into as much detail as I did in the past. So I just summarize the most interesting results of my search for the meaning of the numbers in the Book of Numbers.

Before reading 'Akzent' 8, it is necessary to read 'Akzent' 7, or my article "Bileams Rätsel"<sup>2</sup>, if you prefer to read German.

My remark from July 2005 at the end of 'Akzent' 7 still holds: I believe to have found the right direction of approach to these numbers. Soon after publication of that article, I dropped the gematrical interpretation of the numbers 130 and 170. It can be dropped easily, because on the one hand, it is kind of artificially superimposed onto the statistical part, on the other hand, these two numbers are not among the census numbers as written in the Bible.

Furthermore, the attempts to prove the use of gematria in Biblical Hebrew have failed until now<sup>3</sup>. This is something I did not know in 1996, and it mystified me, given the natural use of gematrical explanations by some theologians. As a lay person, it is difficult to check out what factual claims of theologians can be relied upon. However, I don't mind, because you can never exclude such a proof to be found in the future.

Finally, the gematrical interpretation turned out to be of no assistance in my attempt to discover the meaning of other numbers in the Book of Numbers.

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0 I corrected a few typos. A confusing one was on pages 5 and 10 where I forgot to delete the denominator '355 days' in  $60355 \text{ days} / 355 \text{ days} = 170 * 355 \text{ days} + 5 \text{ days}$ , when rearranging these numbers.

1 Subheadings are one-liners from "Once Upon a Time in the West", 1968, and should not be taken dead seriously. - I did not write 'Akzent' 8 having a 'scientific' journal in mind, but just to get this information out the door. I honestly think it would be unfair to leave it in the drawer any longer. Maybe some 'young guns' out there would like to try their hands at this stuff.

2 "Bileams Rätsel - Die Zählung der Wehrfähigen in Numeri 1 und 26", ZAW 111 (1999) 404-415

3 S. Kreuzer, 'Zahl' (I.4.), NBL III (2001), 1155-1169, holds that an early use of the letters as digits has not been demonstrated.

## ***"I don't have time to compete with you."***

The statistical consideration and deciphering has been commented on by Th.Hieke, who sees an enormous complexity ("ungeheuere Komplexität"<sup>4</sup>) in it. The relativity of this assessment can be realized by comparing the statements of physicists and mathematicians who read my article. All of them made ironic comments about the triviality of the mathematics. Moreover, the impression of the transformations being complicated is obviously based on confusing enciphering and deciphering, a problem to which I hinted already at that time. It seems to be connected with the wrong perception that the later readers would have to be able to decipher the construction, otherwise it would make no sense. But the sense of a riddle is independent of the possibility if it can be solved.

R.Achenbach finds fault with my analysis' eliminating elements of the 'numbers building' ("Ausschaltung von Elementen des Zahlengebäudes"<sup>5</sup>). Obviously, the reduction of the two double numbers is what disturbs him, but he does not tell why. However, this procedure *should* not disturb him, because the authors / redactors eliminate the tribe Levi from the census of the men who were able to serve in the army, while Joseph – illogically – is substituted by his sons Ephraim and Manasseh, thereby bringing the number of tribes to 12 again, or to 13 for that matter. This eliminating and substituting of complete tribes, in principal, is much the same as I have done, and at least as disturbing.

Achenbach further criticizes my failure to show by historical comparison this construction to be probable ("durch historisch vergleichende Einordnung wahrscheinlich" zu machen<sup>6</sup>). He is right on this one, but change is going to come with this 'Akzent'.

Neither Hieke nor Achenbach make any attempt to appreciate the statistical characteristics of the numbers<sup>7</sup>.

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4 Th.Hieke, Art. Volkszählung/Zensus (2.2), WiBiLex, [www.wibilex.de](http://www.wibilex.de) (Access on 20.9.2007).

5 R.Achenbach, Die Vollendung der Tora, BZAR 3, 2003, 443-498 (471).

6 R.Achenbach, Die Vollendung der Tora, BZAR 3, 2003, 471 Anm.107.

7 In his attempt to explain the number 22273, Achenbach (495 fn.178) shows where this lack of appreciation leads, in building his own riddle: He subtracts 22273 from the number 24000, which appears several times in 1.Chr. 27,1-15 (!). So he arrives at the difference 1727. If we add 1 to this difference (why should we do that?), we get 1728 = 12\*12\*12 (why is this number relevant?). And this means, we are told, that the number of Israelites had not been complete (,vollendet'). Not surprisingly, he does not give any historical comparison for 12<sup>3</sup> and 1.

## ***"We'll have to think of another solution. Simpler. Quicker."*<sup>8</sup>**

Still, in my view, the statistical analysis is the strongest part of my first approach to the numbers in Numbers. The occurrence of the number  $14600 = 40 * 365$  is remarkable, not to be expected by chance, and easily interpreted as the 40 years of wandering in the desert.

With the gematrical meaning cut off, we have to address, again, the problem of the meaning of the numbers. The Hebrew Bible contains many date specifications, other Jewish literature of the ANE is discussing questions of astronomy and calendar, so, possibly there is an astronomical information in these numbers as well. In section 4 of 'Akzent' 7 I already discussed this possibility, because some numbers like 354 and  $40 * 365$  do hint to an astronomical background.

In 1977 Michel Barnouin<sup>9</sup> tried to connect the census numbers with the synodic cycles of the planets. This was a really good idea, although not crowned with too much success. It was this lack of success of an obviously good idea, among other reasons, that led to my gematrical explanation attempt. Neither the Hebrew lunar calendar, nor the synodic cycles of the planets lead to a convincing solution, as far as I know, they do not even come close. So what is the real© solution?

Many years ago, the sequence of the middle digits of the sums 603550 and 601730 had attracted my attention: They contain the length of a sidereal lunar year = 355 days<sup>10</sup> and the length of the eclipse period = 173 days. I considered this to be pure chance and believed knowledge about these phenomena in ancient Israel to be unlikely. So I discarded it right away. Seeing is not believing.

The solution of the riddle, as we have seen in 'Akzent' 7, needs the assumption that at least one of the most important numbers has been deposited in a somehow 'encrypted' way, by combining small numbers with big, rounded numbers. In 22000 and 600000, the 3 and 5 lowest decimals are zero, resp., so an additional number can be added in that place<sup>11</sup>. I already assumed such an encryption for the number 22273. The addition of 22000 and 273 is explicitly demonstrated in the Bible, so I could use it successfully for the decryption.

Now I put forward an analogous hypothesis for the main sums:

$$\begin{array}{l} \text{and} \qquad \qquad \qquad 603550 = 600000 + 3550 \\ \qquad \qquad \qquad \qquad \qquad 601730 = 600000 + 1730 \end{array}$$

If the number 355 and 173 have been added intentionally, then they mirror a knowledge about moon observations that cannot be derived from banal characteristic numbers like 354. People must have

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8 No, this is not a K.R.Popper quote, Frank said this, but I would like you to know that my approach is motivated by a remark K.R.Popper made: "Man habe den Ehrgeiz, seine eigenen Theorien zu widerlegen oder zu ersetzen: Das ist besser, als sie zu verteidigen und es anderen zu überlassen, sie zu widerlegen. Doch man vergesse auch nicht, daß eine gute Verteidigung einer Theorie gegen Kritik notwendig zu jeder fruchtbaren Diskussion hinzugehört, denn nur dadurch zeigt sich, wie stark sie ist und wie stark die gegen sie gerichtete Kritik." - K.R.Popper, "Objektive Erkenntnis", Hoffmann und Campe, 1973, S.293/294. - (Sorry, I have no English copy at hand.)

9 M. Barnouin, "Les recensements du Livre des Nombres et l'astronomie babylonienne", VT 27 (1977) 280-303.

10  $13 * 27.32166 \text{ days} = 355.18158 \text{ days} \approx 355 \text{ days}$ .

11 The numeral notation in Hebrew lends itself even more to this approach than modern numbers notation, since all zero digits are simply left out. Smaller numbers can be added by simply continuing a bigger one.

observed and analyzed sidereal moon positions, something that goes clearly beyond measuring the solar year and synodical months.

However, so far I doubt the number 173 to be actually the eclipse period of the moon. Perhaps this number was used to create the difference  $355 - 173 = 182$ , which is approx. half a solar year.

## ***"How much?" - "One Dollar."***

One important goal of ancient astronomy was to find integer number expressions for the relations of periods. A very important relation is between years and days. E.g. in the case of the 'exact' solar year of  $365 \frac{1}{4}$  days ('egyptian year'), we get 4 years = 1461 days<sup>12</sup>.

We can do the same for the synodical and the sidereal month, 29.53 days and 27.32 days<sup>13</sup>. Leaving out some boring and time consuming details, we find the two cycles:

$$\begin{aligned} 17 * 29.53 \text{ days} &\approx 502 \text{ days} \\ 28 * 27.32 \text{ days} &\approx 765 \text{ days} \end{aligned}$$

This means, after 502 days, at the same time of day (observation time), the moon has the same phase again, and, after 765 days, at the same time of day, the moon stands near the same star again.

This does not mean that the moon can always be seen in the same direction or that it can be seen at all, but if it can be seen, then having the same phase and standing near the same star, resp.. These numbers would be a valuable tool for bridging observation gaps and checking observation data.

The surprising thing, of course, is the fact, that 765 is among the numbers of the census.

There are some more numbers that are interesting multiples of the lunar month lengths, e.g.  $10 * 27.32 \text{ days} \approx 273 \text{ days}$ , where 273 is the well known number mentioned above. But I leave out the major part of these details in order to achieve my goal of putting this information out at all.

In this place there should be a statistical test on the hypothesis that these numbers were inserted into the census numbers in Num.1 (by chance, or not), a test which I carried out, of course. I hasten to say that the error probability came out to be no better than between 5 and 10%. One cannot build anything on this result alone. But there is more information in these numbers, as we shall see.

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12 I do not distinguish between sidereal and tropical solar year, since at that time this distinction was not made anyway.  
- Otto Neugebauer, "The Exact Sciences In Antiquity", Brown University Press, 2. ed. 1957, 240pp. and 14 plates (p.140).

13 More precise mean values are 29.53059 and 27.32166.

## **"Now, shall we get back to our little problem?"**

So, if the census numbers are not to be taken as meaning people, not be taken as having some gematrical meaning, but instead something astronomical, what is the physical unit to be applied? If we take the factor of 10 out of these numbers - and I do not want to explain again, why -, these numbers have the unit 'days'.

We can take the main sums and divide them by the sidereal and synodical lunar year lengths. Then we get:

$$\begin{aligned}60355 \text{ days} &= 170 * 355 \text{ days} + 5 \text{ days} \\60173 \text{ days} &= 170 * 354 \text{ days} - 7 \text{ days}\end{aligned}$$

So the 600000 men able to serve in the army turn out to be approx. 1700 lunar years, or better, 60000 men represent approx. 170 lunar years, which reminds us, by the way, of the 170 solar years in the formula  $170 * 365 - 130 * 365 = 40 * 365$ .

If we consider integer numbers only, we can estimate the probability for the number 60355 to be a multiple of the 'embedded' number 355:

$$11/355 \approx 3,1\%$$

which is statistically significant<sup>14</sup>.

Dividing 60173 by 354 seems obvious, you just check out the candidates: 173 and 355 as well as the classical 354 and 365 or 365.25, resp.. Only the multiples of 354 get into the immediate vicinity of 60173, surprisingly also for 170 lunar years.

## **"I figure it ain't gonna look like much."**

We do not have to claim the main sums to correspond to real observation times. But claiming these numbers to have an astronomical meaning, means that these sums were deliberately designed. How could such a design look like?

$$\begin{aligned}170 * 355 \text{ days} &= 60350 \text{ days} \\170 * 354 \text{ days} &= 60180 \text{ days}\end{aligned}$$

The trailing digits '350' accidentally approximate the length of a lunar year. One can easily substitute them with a real lunar year, e.g. 355 days, and enforce a difference of 182 (=355-173) days, *without* rendering the 170-year-design irrerecognizable, because the changes are very small compared to the sums.

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<sup>14</sup> For 355 one would get 1/355 on a rectangular distribution. However, because of the +5 days, we take into account a range of tolerance of +-5. So we would call 11 numbers 'valid' multiples, i.e. the exact multiple plus 10 approx. multiples in the vicinity of the exact one.

This can be called a play on numbers, and I assume this or something similar to have taken place. Of course this cannot be proved, but it makes sense within the context of my explanation, which I hope to make plausible in the course of this 'Akzent'.

### **"Looking for this?"**

Where do the 170 lunar years come from? I don't know. There could be more than one reason to choose 170 years. However, I will give a simple explanation of how this number can become interesting in an astronomical context.

Both the lunar years and the month/(integer) day relationships are relations to a number of months. Let us take a look at the synodical characteristics:

$$\begin{aligned} 1 \text{ synodical lunar year} &= 12 * 29.53 \text{ days} \approx 354 \text{ days} \\ 1 \text{ synodical-month-period} &= 17 * 29.53 \text{ days} \approx 502 \text{ days} \end{aligned}$$

Now the question arises, after how many *years* do we have an integer number of days? This is the case after 17 synodical lunar years, so we have

$$17 * 354 \text{ days} = 6018 \text{ days}$$

If this is the idea behind the 170 years, then it is a consideration based on the synodical motion of the moon. This should not be too surprising, because even if we have sidereal characteristics in the census numbers, this does not mean that a sidereal *calendar* was used or that synodical characteristics were disposed altogether. The traditional lunar calendar was always based on synodical movements of the moon, as far as we know. But we can apply the 17 years to sidereal motions as well, although there is no special astronomical observation to be expected after this time:

$$17 * 355 \text{ days} = 6035 \text{ days}$$

Now there is only a factor of 10 (or 100) missing, plus the substitution of 355 and 173.

But this is almost kind of a digression. There may be other reasons to play around with a 170 year design. 60000(0)+X could simply be a number handed down via some tradition etc.. If there were no more information about astronomical aspects than those shown in the previous sections, I would not bother anyone with this stuff.

### **"What are we gonna do with this one, Frank?"**

The Levites were not allowed to be counted among the men serving in the army. So possibly they should have a different unit than days. We can find out about this by simply putting their sum, and the sum of the firstborn for that matter, into a relation with the main sum of the able-bodied men in

Num.1:

603550 days / 22273 month  $\approx$  27.1 days/month (firstborn)  
603550 days / 22000 month  $\approx$  27.4 days/month (Levites)

or, using the rounded value 600000:

600000 days / 22000 month  $\approx$  27.3 days/month (Levites)

This is approx. the length of the sidereal month. So the number of the Levites turns out to be quite precisely the number of sidereal months, and the number of the firstborn is not far off. The sum is not exactly equal to the 170 years, but they come close ( $22000 * 27.32166 \text{ days} \approx 601077$ ).

If the unit for the number of Levites in Num.3 is 'sidereal month', then they cannot be added to the numbers of the soldiers in Num.1. This 'explains' the fact, that the Levites were not to be counted among them, cp. Num.1,47ff. Even the instruction to count the male Levites being "a month old or more", sounds fitting.

The numbers of the Levites and the firstborn *can* be compared. Furthermore, the digits of the number 273, which is added to 22000 as a key, suspiciously look like the digits of the sidereal month. However, this number must not be able to be set directly against the census numbers, since at some point of this numbers game factors of 10 have been introduced to make them look more impressive. The main purpose of 273 and 1365 (= 5 \* 273) seems to be to achieve the 'right' digit sequences in the main sums 603550 and 601730.

The magnitude  $603550/22273 \approx 27.1$  of the relation between the Israelite soldiers and the firstborn was a constant source of mystification for generations of exegetes down to this very day. No wonder, astronomical relations do not lend themselves naturally to strange mappings of subsets of human populations.

Last but not least, the illogical substitution of Ephraim and Manasseh for Joseph leads to a de facto number of 13 tribes, disregarding the fact that Levi should not be counted among the others. So, how many tribes did Israel have at the end of the day, 12 or 13? The answer is clearly ambiguous: Both! 12 tribes match the 12 months of the standard synodic lunar year, 13 tribes match the 13 months of the sidereal lunar year.

### **"End of the line."**

What do the numbers of the serving Levites in Num.4 mean? The context leads us to expect these numbers to have some time unit as well, probably in connection with the motions of the moon. However, I did not get it.

At least some 'direction' seems to be given in the text by defining the servants as being men from 30 to 50 years of age. This expression looks like a time to be *inserted* somewhere, so possibly some intercalation. This would be in line with the fact that the Levites are assigned to their service by the priests, the definition of intercalations being a familiar means of the wielding of power in ancient

religious-political hierarchies<sup>15</sup>.

### **"I don't want to waste any more time."**

I could go on for dozens of pages, writing stuff about a 130-year-cycle<sup>16</sup> between solar year and un-intercalated lunar year, a 300-year-cycle<sup>17</sup> between sidereal lunar year and un-intercalated lunar year, even a 40-year-cycle<sup>18</sup> of lunar eclipses based upon their sidereal positions is there. One can derive explanations for census numbers like 322 and 644 etc.. I am sure that quite a couple of people would not hesitate to write a book about all this stuff. But it did not really convince me.

I confine myself to some remarks on the design. First of all: Does it make sense? The main reason for me to search for an astronomical explanation in the first place was the fact that astronomical and calendrical questions were of huge importance in ancient times. An astronomical explanation does make sense from the outset.

Can my suggestions be proved in the exact sense? I don't think so. I did not even succeed in providing a comprehensive statistical model which could be used for a convincing test. The information that I extracted so far is too little and too heterogeneous for this purpose. So, at this point in time, I do not see a possibility to show that the sidereal characteristics are not there by chance.

However, we can compare my hypothesis to the solutions that have been proposed in the past. Then I would go so far as to claim that my astronomical explanation is better than any other interpretations that have been given. (This includes my gematrical digressions, but excludes my statistical analysis, of course.) Some of them are so vague, they do not even interfere with an astronomical interpretation. For instance, one can agree with E.Davies' statement

"The aim of the Priestly writer was almost certainly to demonstrate the miraculous power of Yahweh who was able to sustain such a large throng during the trials and tribulations of the wilderness wanderings."<sup>19</sup>

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15 Cp. e.g. the 'calendar wars' in the time of the Dead Sea Scrolls.

16 Based upon an integer number constraint on the intercalation time measured in solar years, one can find:

$130 * 365.25 \text{ days} = 130 * 354 \text{ days} + 4 * 365.25 \text{ days}$ . As long as you do not know the Meton cycle, this cycle would be of practical use for estimating the time to be intercalated in the luni-solar calendar during 130 solar years. - This cycle is just an example to show that it is of no use to claim „he cannot explain“ this or that. There are surprisingly many cycles to be found in astronomical numbers that can 'explain' other numbers but, like this one, one single coincidence between a cycle number, and a number (130) only *derived* from the census numbers is not enough.

17 Based upon an integer number constraint on the difference of lunar years measured in lunar years, one can find:

$300 * 355.18158 \text{ days} - 300 * 354 \text{ days} \approx 354.5 \text{ days} \approx 1 \text{ lunar year}$ . 300 years are interesting because  $300 = 170 + 130$ . This cycle must not have been observed, but can be calculated by using the fact that after 11 years the difference between the two lunar year types is almost exactly 13 days, so  $300 * 13 \text{ days} / 11 \approx 3900 \text{ days} / 11 \approx 354.5 \text{ days}$ . However, it has the same drawback as the 130 year cycle.

18 Observing the sidereal position of every second lunar eclipse (the ones in the same hemisphere), one can find a cycle of 40 eclipse years  $\approx 39$  lunar years  $\approx 38$  solar years, after which time this position has circled the sky *and* the starting point of the (sidereal and synodical) lunar years is in the same hemisphere as well. - The 40 and 38 years remind us of the rebellious people who ought to be wandering in the desert for 40 years and die (Num.14,32-34; Dtn.2,7), however, strangely they were dead already after 38 years (Dtn.2,14). - Of course, there is a connection to the number 173 in 601730, but I could not convince myself this to be enough to claim that the ancient Israelites in fact had so much astronomical knowledge.

19 Eryl W. Davies, "A Mathematical Conundrum: The Problem of the Large Numbers in Numbers I And XXVI", VT



without having to discard the astronomical meaning of the numbers, and vice versa. At the same time, declaring a general aim of the writers does not explain one single number, in contrast to my astronomical interpretation.

Attempts to take the numbers to be historical in the literal sense have thoroughly failed<sup>20</sup>.

Do we have a reference point for historical comparison that has been asked for. Yes, I think so. The characteristic numbers refer to astronomical and in so far historical phenomena. Do we have a suitable literary context in ANE literature? Yes, obviously. We do not find sidereal characteristics as such, as far as I know, but an appropriate background of astronomical knowledge.

In short, how did 'they' do it? As a background, I guess there was an ongoing struggle for a story worthy to represent the formation of the Israelite religion, and consequently a struggle to put in some of the best information at hand. This information had to contain elements that were genuinely created or explored by themselves, to make the story distinctively their own and to elevate their God in doing so. I see this struggle much in line with the 'calendar wars' known from the Dead Sea Scrolls, where we see people threatening to torture and kill each other in order to enforce their religious views which in turn hinge on their specific calendar definition.

The sidereal month was obviously not accepted for non-astronomical purposes. But it was used to bind the hierarchical dependency of the Israelites on the Levites and priests to some 'heavenly' structure.

The census numbers were not freely invented, of course. One can easily imagine that there were records of astronomical observations and calculations from which to draw these numbers. The next problem was, what information to put into the census numbers, synodic or sidereal lunar motions, characteristic numbers of the solar year or whatever. Finally, the numbers could not be too well defined. Anybody who invented some fairly complex design knows, you always need some free parameters to make it work in the end. So, the statistical structure that I described in 'Akzent' 7 may possibly be just a relict of the design exercises these numbers had to go through.

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45 (1995) 449-469. – S.468.

20 I wrote review 4 on my homepage on the last one that I heard of.

## Abstract

For quite some time I tried to find an astronomical meaning in the census numbers, building on the statistical information I retrieved and discarding the gematrical parts that I wrote about in 'Akzent' 7. In this 'Akzent' 8, I try to shortly summarize the most interesting pieces that I have got so far, leaving out quite some details because of increasing time constraints. There is no exact proof for the following hypotheses. However, I claim this model to be more convincing than any similarly detailed model that has been put forward. -

The sequence of the middle digits of the sum 603550 contains the length of a sidereal lunar year = 355 days. This additive construction is similar to  $22273 = 22000 + 273$ , which contains the digits of 27.3 days, the length of the sidereal month. 765 is a sidereal cycle number of the moon. The census numbers of the soldiers, divided by 10, have the time unit 'day' and correspond approx. to 170 lunar years:

$$60355 \text{ days} = 170 * 355 \text{ days} + 5 \text{ days}$$

$$60173 \text{ days} = 170 * 354 \text{ days} - 7 \text{ days.}$$

The time unit for the firstborn and for the Levites 'a month old or more' is the sidereal month. The Levites and the soldiers stand in relation to each other:

$$600000 \text{ days} / 22000 \text{ sidereal month} \approx 27.3 \text{ days/sidereal month.}$$

Having different time units, the Levites should not be included in the 'census' of the others.

Counting the tribes of Israel, we get at least 12 and 13 as result, depending on the inclusion of Levi, Ephraim and Manasseh. There are 12 months in a synodical, and 13 months in a sidereal lunar year, resp..

Some material given in footnotes is intended for 'young guns' who may want to try their hand at this stuff. I am sure there is still much to be done on this subject.