

Symmetrically Designed Sifrei Torah: A Quantitative Analysis

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The Talmud and Midrash are replete with obscure texts that are difficult to decipher. At times the problem is the use of obscure words, phrases or idioms, and considerable effort and analysis may be required to clarify the issue. Other times it is not the literal wording of the text that causes the difficulty but rather that the statements contradict “facts” we “know” to be true. There is abundant literature of this genre of problems dealing with the resolution of scientific “inconsistencies.” These types of questions are not the focus of this paper. Rather we are concerned here with resolving problems where the *Gemara* asserts mathematical facts that simple counting or enumeration demonstrates to be patently incorrect. In this situation it is not uncommon for both early and late commentators to change the text or offer clever and often ingenious solutions to reconcile the discrepancies. While these “ingenious” solutions maintain the integrity of the words in the text, they often miss the mark and may even diminish people’s respect for “Talmudic reasoning.”

This paper addresses one such well-known *Gemara* that as simply understood rejects the textual accuracy of our current *Sifrei Torah*. We review the brilliant and creative solutions offered to maintain the integrity of our *Sifrei Torah*, but show how none of these answers, individually or even collectively, address the underlying difficulties raised by the *Gemara*. We then proceed to demonstrate that rather than challenging our current text, the underlying mathematical structure of the *Gemara* confirms the accuracy of our current *Sifrei Torah* and our subdivision into verses. Based on the mathematical symmetry of the *Gemara*, we then conjecture that the objective of this *Gemara* was to describe how a *Sefer Torah* should be written. While some may not agree with our conjecture of purpose,

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our quantitative analysis challenges the underpinnings of all previous avenues of interpretation and must be dealt with by anyone offering a competing theory. Our hope is that our paper will encourage further research into the intent of this *Gemara* and give pause to those who are willing to jump to conclusions about our Masorah and tradition based on *Gemaras* that are obscure and puzzling.

The Text

לפיכך נקראו ראשונים סופרים שהיו סופרים כל האותיות שבתורה, שהיו אומרים וא"ו (ויקרא יא) דגחון חציין של אותיות של ס"ת, (ויקרא י) דרש דרש חציין של תיבות, (ויקרא יג) והתגלה של פסוקים, (תהלים פ) יכרסמנה חזיר מיער עי"ן דיער חציין של תהלים, (תהלים עח) והוא רחום יכפר עון חציו דפסוקים. בעי רב יוסף וא"ו דגחון מהאי גיסא או מהאי גיסא? א"ל ניתי ס"ת ואימנינהו מי לא אמר רבה בר בר חנה לא זז משם עד שהביאו ספר תורה ומנאום? א"ל אינהו בקיאי בחסירות ויתרות אנן לא בקיאינן. בעי רב יוסף והתגלה מהאי גיסא או מהאי גיסא? א"ל אביי פסוקי מיהא ליתו לימנוי. בפסוקי נמי לא בקיאינן דכי אתא רב אחא בר אדא אמר במערבא פסקי ליה להאי קרא לתלתא פסוקי (שמות יט) ויאמר ה' אל משה הנה אנכי בא אליך בעב הענן. תנו רבנן חמשת אלפים ושמונה מאות ושמונים ושמונה פסוקים הוו פסוקי ס"ת יתר עליו תהלים שמונה חסר ממנו דברי הימים שמונה. (קדושין ל עמוד א)

Because of this reason the *risbonim* were called *soferim* for they counted all the letters in the Torah. They used to say the “*vav*” of “*gachon*” represents the halfway point of the letters of a *Sefer Torah*, “*Darosh Darosh*” represent the halfway point of the words, “*V’Hisgalach*” of verses. “*Yecharsemenu ...*” the *ayin* of *ya’ar* is the halfway point of *Tebillim*, “*V’hu Rachum ...*” is the halfway point of the verses. Rav Yosef asked if the *vav* of *gachon* is from this side or that side? They told him, “Let’s bring a *Sefer Torah* and count it. Did not Rabbah bar Chanah say, “They did not move from there until a *Sefer Torah* was brought and counted”? He replied “they are experts in missing and extra [letters], we are not experts.” Rav Yosef asked is *V’Hisgalach* on one side or on the other? Abaye said to him, “for verses at least let us bring (a Torah Scroll) and count?” No, in verses as well we are not experts, because when Rav Acha bar Ada came he said, “in the West [Israel] they have separated this verse into 3 verses, “*V’Yomer*” The rabbis taught that 5,888

verses are the verses of the *Sefer Torah*; *Tebillim* has eight more; *Divrei Hayamim* has eight fewer.

Analysis

1. *Rishonim and Soferim*

לפיכך נקראו ראשונים סופרים שהיו סופרים כל האותיות שבתורה.
רשי ד"ה לפיכך. מלתא באפי נפשה היא.
ד"ה נקראו ראשונים סופרים. כדכתיב (דברי הימים א:ב:ג) ומשפחת
סופרים יושבי יעבץ.

Rashi first addresses the apparent lack of relationship between this *Gemara* and the previous *sugya* that recommended that a person divide his time equally (i.e. 1/3 each) between *Mikrah*, Mishna and Talmud. Rashi asserts that the two *Gemaras* are indeed not connected and that this is the start of a new discussion. Generally speaking it is not the norm for the *Gemara* to abruptly transition from one topic to another without some common element to link them. Rashi next explains the reference to “*rishonim soferim*.” The use of the designation *rishonim* is certainly justified according to Rashi, as the people being referenced in the text he cites are early settlers of Eretz Israel not long after the Exodus. The meaning of סופרים (in the question) is less clear. Even-Shoshan’s concordance has 54 references for all variations of סופר in נך (it never appears in *Chumash*) of which he translates 47 as דברים מזכיר, כותב. The remaining 7 citations all appear in Ezra and are translated as “a scholar who copies *Sifrei Torah*.” Thus according to Even-Shoshan, the verse Rashi cites for *sofer* means “a clerk or someone who writes down words,” with no apparent reference to “scholar.” It would therefore appear according to Rashi that the *soferim* we are talking about are scribal practitioners with no special claim to scholarship, whose job is to accurately transcribe what has been written or said.

Tosfos cites Rashi and comments:

ובירושלמי מפרש שעשו כל התורה כולה מספרות כגון אבות מלאכות
ארבעים חסר אחת וארבעה אבות נזיקין וכיוצא בהם.

In this context *sofer* is being used, as it frequently is in the *Gemara* and *rishonim*, to refer to Rabbinical law, i.e. דברי סופרים¹. *Soferim* then does not refer to scribes at all, and *rishonim* would refer not to the early Jewish settlers upon their initial entry into Eretz Yisrael, but to the early *Chachamim* of the 2nd Temple era² perhaps starting with Ezra.

עזרא ז:יא וְזֶה פִּרְשֵׁנוּ הַנְּשִׁיתָנוּ, אֲשֶׁר נָתַן הַמֶּלֶךְ אֶרְתַּחְשֶׁשְׁתָּא, לְעֹזְרָא
הַכֹּהֵן, הַסֹּפֵר: סִפֵּר דְּבָרֵי מִצְוֹת ה', וְחָקְיוּ עַל יִשְׂרָאֵל.

¹ Examples of the word סופרים being used in the Mishna, *Gemara* and Rambam to denote Rabbinical rulings that have nothing to do with *Sifrei Torah*, include:

משנה ידיים ג:ב כל הפוסל את התרומה, מטמא את הידיים להיות שנייות. והיד מטמא את חברתה דברי רבי יהושוע; וחכמים אומרים, אין שני עושה שני. אמר להן, והלוא כתבי הקודש שניים, מטמאין את הידיים. אמרו לו, אין דנין דברי תורה מדברי סופרים, ולא דברי סופרים מדברי תורה, ולא דברי סופרים מדברי סופרים.

יבמות פה: קנסו אותו כתובה ומפני מה אמרו שניות מדברי סופרים אין להן כתובה... דברי תורה ודברי תורה אין צריכין חיזוק והללו דברי סופרים ודברי סופרים צריכין...

משנה תורה הלכות שבועות יא:ד שבועה זו שמשביעין הדיינין למי שנתחייב שבועה, היא הנקרא שבועת הדיינין, בין שהיה חייב בשבועה זו מן התורה, בין שהיה חייב בה מדברי סופרים.

In all of these cases the *halachos* mentioned as being attributed to the *soferim* are of very early rabbinic origin.

² E.g. *Encyclopedia Talmudis* "Divrei Soferim": ראשוני חכמי תורה שבעל פה. Ephraim Auerbach, Tarbitz 1958, says they were 2nd Temple scribes. Even though Tosfos offers the *Yerushalmi* as an alternative to Rashi's connecting the *soferim* to the verse in *Divrei Hayamim*, the *Yerushalmi* itself makes the same reference to *Divrei Hayamim* and then goes on to offer the explanation dealing with the codification of the numbers:

ירושלמי שקלים ה:א אמר ר' אבהו כתיב (דברי הימים א:ב) ממשפחת סופרים יושבי יעבץ מה ת"ל סופרים אלא שעשו את התורה ספורות ספורות, חמשה לא יתרומו תרומה, ה' דברים חייבין בחלה, חמש עשרה נשים פוטרות צרותיהן, שלשים ושש כריתות בתורה, שלשה עשר דבר נאמרו בנבלת העוף הטהור, ד' אבות נזיקין, אבות מלאכות ארבעים חסר אחת.

It is also interesting that of the *Yerushalmi's* 7 examples of the *Chachamim* making counting codifications, Tosfos cites only the last 2 (and in reverse order).

ירושלמי שקלים ה:א - אמר רבי אליעזר כתיב (עזרא ז) לעזרא הכהן הסופר מה ת"ל סופר אלא כשם שהיה³ סופר בדברי תורה כך היה סופר בדברי חכמים.

The counting mentioned by Tosfos from the *Yerushalmi* refers to the early *Chachamim* codifying *halacha* and rules in ways to make it easier to remember. Thus, according to Tosfos the *soferim* we are talking about are codifiers whose goals were to establish law and offer it to the people in the clearest most memorable way.

In the final analysis, albeit for different reasons, both the *Bavli* and *Yerushalmi* relate the word *soferim* to “counting.” However, where the *Bavli* relates it to counting words in the Torah, the *Yerushalmi* says it refers to counting *halachos*.

2. Number Sources

As indicated in the first line of the *Gemara*, numerical counts are going to be at the heart of this paper. These counts will include how many letters, words and verses there are in *Chumash* and in other *כתבי הקודש*. Before continuing our analysis of the *Gemara*, it is therefore important to clarify the sources of the different counts that appear throughout this paper. It is common knowledge that in almost all *Chumashim* there are numbers at the end of every פרשה indicating how many verses are in the *parasha*, followed by a סימן, which could be a name, word or phrase, whose גמטריא equals the stated number. In all but a very few cases these numbers exactly equal the manual count of the actual verses. A discussion of the historical origin of

³ This statement immediately follows the statement in the *Yerushalmi* given in the previous footnote. We understand (see פני משה) that Rebbe Eliezer was addressing the use of סופר twice in verse 7:11. He interpreted the first *sofer* as referring to Ezra being a scribe, e.g. we know Ezra introduced a new Hebrew alphabet
אמר מר זוטרא ואיתימא מר עוקבא בתחלה ניתנה תורה לישראל בכתב עברי ולשון הקודש חזרה וניתנה להם בימי עזרא בכתב אשורית ולשון ארמי ביררו להן לישראל כתב אשורית ולשון הקודש והניחו להדיוטות כתב עברית ולשון ארמי.
and was questioning the meaning/need for the second *sofer*. His answer was that, according to R' Avahu, Ezra gave numerical counts of *halachos*.

these numbers and *simanim*, and the changes they have undergone over time, is given by Ahrend.⁴ Based on existing manuscripts, he dates the first number counts of *Chumash* to no later than the 8th or 9th century, and the first use of *simanim* to the 10th or 11th century. Ahrend points out that the original *simanim* were all men's names from נג, and shows that after the invention of the printing press, successive editions of מקראות גדולות had additional changes in both the number count and the types of things that qualified to be used as *simanim*. The age and authenticity of the original numbers and *simanim* on the *parashiot* of *Chumash* are also attested to by שי מנחת who uses them to authenticate the spelling of a name, e.g.

עזרא י:מ מְכַנְדְּבֵי שְׁשִׁי, שְׁרִי.
מנחת שי⁵: מכנדבי. בספרים מדויקים בכ"ף אחר המ"ם לא בבי"ת וראיה גדולה לדבר שהרי הוא סימן לפסוקי פ' לך לך שהם קכו.

Ahrend does not comment on the history of the aggregate numerical counts also found at the end of each of the:

- Five חומשים of the cumulative number of verses, words, letters and other information as contained in the ספר.
- Other כתבי הקודש.

In a less scholarly and more speculative work, תורת יעקב סימן, פז also discusses the numerical counts and *simanim*, and quotes מסורת⁶ התורה והנביאים as follows:

חכמי טבריה אחר חתימת התלמוד ספרו ומנו תיבות הפסוקים ופרשיות שבכל כד ספרי קדש, ומסרו לנו סימנים שם אדם שהוא בגמטריא כמספר

⁴ Mordechai Breuer Festschrift, "הסימנים של מנייני הפסוקים", 1992, Jerusalem Academon Press, pp. 157–171.

⁵ *Minchat Shai* was written to correct the errors of *Mikra'ot Gedolot*, Venice 1524–1526 (Breuer). Note the *siman* for לך לך in current *Mikra'ot Gedolot* is not a name but a word from the end of the *parasha*.

⁶ סדר הדורות dates this work to שזו (1617) and offers the following comment about one of the assertions therein:

בהקדמה ג' לס' מסורת המסורת אמר "אנשי טבריה היו חכמים גדולים ובקיאים במקרא מהם קבלנו כל הנקוד" והאמת כי אנשי כנסת הגדולה הם היו בעלי המסורת והנקודות.

אותיות הפרשה. "ומה שכתב "אותיות" הפרשה נראה טעות סופר וצריך לאמר "תיבות" הפרשה דוק.

Based on all of the above, we will cite the number counts as given in the different *Chumashim* and *Neviim* as being authoritative but at the same time also supply numbers based on an actual count of the texts that we have. It is our objective to show that there are no significant differences between all of the given and the actual counts

3. Letters

שהיו אומרים וא"ו דגחון חציין של אותיות של ס"ת... בעי רב יוסף וא"ו דגחון מהאי גיסא או מהאי גיסא? א"ל ניתי ס"ת ואימנינהו מי לא אמר רבה בר בר חנה לא זז משם עד שהביאו ספר תורה ומנאום? א"ל אינהו בקיאי בחסירות ויתרות אנן לא בקיאינן.

When the *Gemara* quoted the *soferim* as saying the וו of גחון in **ויקרא** is the middle letter in the Torah, Rav Yosef questioned whether the וו belonged to the first half or the second half. He also insisted that an actual review of a *Sefer Torah* (S"t) would not resolve the question since we are not experts in "added and missing" letters. This last statement refers to the fact that words can often be spelled with or without the letters *vav* or *yud* without affecting the pronunciation and/or the meaning of a word, and thus their inclusion or deletion does not affect the usability of the S"t. Since many of the 30,509 *vav*'s and 31,522 *yud*'s in our S"t of 304,805 letters (see Appendix A, 2nd column)⁷ are in positions in which they may or may not be correct, there is no way for us to answer Rav Yosef's question.

From a mathematical perspective, Rav Yosef's question must assume⁸ an even number of letters, i.e. an odd number of letters has a

⁷ The total of 304,805 is reaffirmed by a count and סימן found in the back of most printed חומשים. These numbers are slightly lower in individual as well as in total letter count (i.e. total of 63 more) found in the back of the תורה תמימה *Chumash*. There are 304,801 letters in a *Sephardic* S"t. See *Rasbi Shemos* 25:22 and other places where it is clear that his S"t is slightly different from ours.

⁸ explains that the word חציין somehow implies an even number of letters.

singular middle belonging to neither half. But the simple implication of the *Gemara* is that there are an odd number of letters, i.e. the *Gemara* mentions 2 middle words but only a single middle letter and middle verse.⁹ If so, what is Rav Yosef asking? Any attempt to say that he was questioning into which half the single middle letter conceptually fits best is insufficient, since there then would be no benefit of checking out a S”T even if we were experts in additions and deletions.

As we said previously our *Sifrei Torah* have approximately 304,805 letters. This makes letter 152,403 the middle letter and places it at the start of ויקרא ה:כט. Hence, the *Gemara*'s middle letter, the וו of גהון, which is approximately letter 157,225 in our S”T, differs from our middle letter by over 4,800 letters. If the difference in the count were due solely to לא בקיאין אנו vis-a-vis *vav*'s and *yud*'s, then our “error rate” in *vav*'s and *yud*'s would be approximately¹⁰ 7.7% (i.e. $4,800 / (30,509 + 31,522)$). Moreover, 7.7% is only the minimum number of changes that have to be made. Since there is an equal chance that the *vav*, *yud* switches are on either side of the median letter, the number of random changes that would result in the middle moving more than 4,800 letters is considerably higher than 7.7%. It is difficult to assume that such an error rate is a realistic possibility.

A search of the literature shows little in the way of resolving the problem. The only solution approach that tries to deflect the problem is offered in outline form by R' Eliyahu Posek¹¹ whereby the *Gemara* is referring not to the regular letters in the Torah but rather to the exceptional letters, e.g. large and small letters,¹² קרי וכתוב, crooked letters etc. Whereas R' Posek did not specifically work out the details

⁹ Although the *Gemara* gives a single center verse, it says that a S”T has an even 5,888 verses. This translates into 2 middle points. We will discuss this later.

¹⁰ This number assumes any *vav* and *yud* is a potential *chaser/yeser*. This is not true because, for example, it does not apply to words starting with *vav* or *yud*. As we shall show later there are 4,194 verses starting with *vav*. Thus the true error rate is higher.

¹¹ In המקרא והמסורה (1928). See also R' Reuven Margalioth פסקי אליהו ג:א p. 45.

¹² For a list of these letters see for example ערוך השולחן י”ד רעג:כה. The וו of גהון as well as the ג of והתגלה is on the list of large letters.

of this answer, R' Isaac Zilber attempted to show a specific set of these “oddities” of which the וו of גחון is in fact the middle one. Many have challenged this answer¹³ primarily on the grounds that any attempt at making a list of “unique” letters such that the וו of גחון is the middle letter:

- Is purely arbitrary,
- Does not fit R' Yosef's question and the Gemara's attempt at resolving it,
- Is contradicted by: סופרים ט:ב - ואו דגחון צריך להיות זקוף שהוא חצי אותיות של תורה

i.e. it is a large letter only because it is the middle letter in the Torah.

We feel the basic question is why the *soferim* would make such a list and identify its middle? As discussed previously, the *soferim* seem to have been practical people and/or codifiers, not theorists. It is highly unlikely that they would deal with the esoteric or metaphysical. Why then would they here indulge in this apparently nonessential exercise?

4. Words

דרש דרש חציין של תיבות.

The *soferim's* choice of ויקרא י:טז, דרש דרש as the middle words in the Torah elicits no question or comment in the *Gemara*. However, a comparison of this choice of central words with our *Sifrei Torah* once again indicates a major discrepancy. The *Gemara* previously said that we are not experts in letters and later says we are not experts in verses. However, nowhere is there a claim that we are not knowledgeable of words. The idea that our Torah is missing words or has extra words is inconsistent with our ¹⁴מסורה. Table 1 lists the

¹³ In addition to R' Reuven Margalioth, see also Moriah 22nd year, issue A-B [153-154], Elul 5788 (1998), hereafter referred to as McKay, at <http://cs.anu.edu.au/people/Brendan.McKay/dilugim/StatSci/anon_middle.pdf> and Menachem Cohen (hereafter referred to as Cohen) at http://cs.anu.edu.au/~bdm/dilugim/StatSci/middle_english.pdf.

¹⁴ See Rashi מט: שבח מט.

number of words in each חומש as well as those in the first few פרשיות of ויקרא:

Table 1

Number of words in the Torah

	# of <u>Words</u>		# of <u>Words</u>
חומש		פרשה	
בראשית	20,614	ויקרא	1,673
שמות	16,714	צו	1,353
ויקרא	11,950	שמיני	1,238
במדבר	16,408	תזריע	1,010
דברים	<u>14,294</u>		
Total ¹⁵	79,980		

According to the actual word count of 79,980, the middle words are words 39,990 and 39,991, i.e. ויקרא ח:טו in יצק אל. The *Gemara's* choice, דרש דרש, are words 40,923 and 40,924. How do we explain a discrepancy of over 900 words?

The existing literature addressing this issue is sparse. R' Isaac Zilber, as he did with respect to the middle letter, again offers a novel

¹⁵ The 79,976 number given in the back of standard *Chumashim* is 4 less than our actual count (the עט סופר מהיר יפיפית is סימן based on the underlined letters). While we know all of the words in the Torah, there are instances in the Torah where there is some question as to whether the letters form 1 or 2 words, e.g.

- *Devarim* 32:6: The first letter in the verse - see Rashi.
- *Pesachim* 117a: א"ר חסדא א"ר יוחנן הללויה תסיה וידידיה אחת הן רב אמר תסיה ומרחביה אחת הן רבה אמר מרחביה בלבד איבעיא להו מרחב יה לרב חסדא מאי תיקו.
- *Chulin* 65a: אלא מעתה (בראשית יד) את כדר לעומר דפסק להו ספרא בתרי הכי גמי דתרתו שמי גינהו.

as well as others. Regardless of whether 79,976 or 79,980 is correct, the discrepancy between the actual middle word(s) and the one the *Gemara* gives is so great that it cannot be explained by “missing” words.

solution. He suggests¹⁶ that the *Gemara* in *Kiddushin* is dealing not with words but rather with pairs of words. He proceeds to list 89 places in the Torah where double words are employed and shows that דרש דרש is the 45th pair.¹⁷ As with his solution with the letters, many have challenged this answer¹⁸ by showing that any list of double letters is arbitrary,¹⁹ e.g. R' Zilber himself first counted 77 pairs and then 85 pairs before settling on 89. And, as in the previous section, we once again raise the question as to why anyone would be interested in making such a list and finding the center of it. Merzbach tries to address this question by offering the following rationale for R' Zilber's general approach:

“We have to remember that the purpose of the *soferim* in the different counts of letters, words, verses and *parashiot* was to preserve the uniformity and precision of the Written Torah. They wanted to give all the holders of Torah scrolls simple testing methods that would enable them to check that nothing was omitted or added to the Torah scrolls that they hold. It is not practical to ask a person to count 80,000 words, so they suggested much simpler checks, though they are less certain.”

Considering: the length of the Torah and the type of errors that can occur, the fact that the Torah is usable even if the “odd” letters are written normally;²⁰ and that the double-word test is by no means that easy to apply and of very limited usefulness, we find this justification of R' Zilber's approach unconvincing.²¹

¹⁶ R' Zilber says he originally found this idea in a book entitled *אהבת תורה* written by R' Pinchus Zalman Segal Ish-Horowitz published in 1905.

¹⁷ For a list of the 89 “doubles” see 334 *דף שבועי מספר* by Eli Merzbach at <<http://www.biu.ac.il/JH/Parasha/shmini/mer.html>> (hereafter referred to as Merzbach).

¹⁸ E.g., McKay and Cohen.

¹⁹ For example: Should:

* לך לך (בראשית יב:א) - words from different roots be counted? – No.

* כה כה (יש - שמות ז:טז) - words in successive verses be counted? – Yes.

²⁰ See Rambam ט ט"ז - ט"ח. Note that he never mentions which letters are big or small.

²¹ See McKay for a much more critical assessment of the value of these “supposed” tests. The author asserts that the actual middle letter, word and verse would have been much more helpful.

5. Verses

והתגלה של פסוקים... בעי רב יוסף והתגלה מהאי גיסא או מהאי גיסא?
א"ל אביי פסוקי מיהא ליתו לימנוי'. בפסוקי נמי לא בקיאינן דכי אתא רב
אחא בר אדא אמר במערבא פסקי ליה להאי קרא לתלתא פסוקי ויאמר ה'
אל משה הנה אנכי בא אליך בעב הענן. תנו רבנן חמשת אלפים ושמונה
מאות ושמונים ושמונה פסוקים הוו פסוקי ס"ח.

The two statements concerning the middle verse and the total number of verses in the Torah are each at odds with the Torah we currently have, as well as inconsistent with each other. Based on the count of verses as summarized in Table²² 2, there are 5,845 verses in the Torah with verse 2,923nd, ²³ ויקרא ח:ה, the true middle verse. The verse the *soferim* identified as being in the middle, והתגלה, ויקרא יג:לג, is the 3,082nd verse. This undercount of 160 verses²⁴ is almost 5.2% (i.e. 160 out of 3,082) of the total number of verses. Moreover, the *Gemara's* final total count of 5,888 verses differs from our count of 5,845 and its middle is verse 2,945. When the *Gemara* says we are not experts in letters or verses it is saying that over time we have lost part of our מסורה. As such, a slight error in the count is possible. However, an error rate of over 5% means that we have a mistake on the average once every 20 verses. It is difficult to believe that in as important a document as the Torah, where meticulous care is given to the preservation and transmission of the text,²⁵ such a high error

²² Table 2 gives the number of verses in each *parasha*, *Chumash* and the entire Torah (i.e. 5,845) as given in most standard *Chumashim*. We have also supplied the number of verses in each *parasha* and *Chumash* based on an actual count of the verses as they appear in our *Chumashim*. Although the actual count has a total of 5,846 verses, without loss of generality, we will use 5,845 for this paper.

²³ פסוק מנחת שי reports this as well.

²⁴ says we need an extra 160 verses in the 2nd half of the Torah to make והתגלה the correct middle. In fact we need 320 more.

²⁵ When we talk about the preservation of the text and Masorah, there is a major difference between letters/words and verses. Letters/words comprise the written text and must be recorded correctly so that the S"Y be permitted to be used. To satisfy any Torah reading, in addition to reading from a text that is properly written, the letters/words must

rate would occur. The *Gemara's* total of 5,888 verses versus our count of 5,845, yielding an error rate of .7% (i.e. 43 out of 5,845), or 1 mistake every 140 verses, is far better, but still high for so important a document.²⁶

Other than attempts amongst the אחרונים to resolve the problem by changing גרסאות of the numbers²⁷ in the *Gemara* or the referenced פסוקים²⁸, the only solution offered is once again by R' Zilber. As with the letters, he suggests the *Gemara* is referring only to verses in which large letters appear. Needless to say the critics do not agree with this either.²⁹

be pronounced properly. Verses do not share this duality. They have no designation in the S"V and have no relevance to the *kasbrus* of the S"V. It is only in the reading of the S"V and in comprehending what is being said that verses are of importance. Ahrend says: מסוגיה זו עולה שבראשית המאה הרביעית זמנם של רב אחא בר אדא ואביי היו חילוקי דעות בין בני בבל לבני ארץ ישראל בשאלה כיצד לחלק את הפסוק בשמות יט:ט אפשר שהמחלוקת נסבה על פסוקים נוספים אך על כל פנים רואים אנו מכאן שבתקופה זו עדיין לא נהגה חלוקה מותקמת לפסוקים בכל הקהילות. Whether or not the disagreement over the division of verses extended beyond the one verse in *Shemos* (according to the המקנה it may very well have been limited to this verse), it is quite clear that the concept of verses is part of the Masorah from Moshe and was part of the rules governing קריאה during the time of the 2nd Temple many years before R' Acha bar Adda and Abaye.

מגילה כב. דתנן ביום הראשון בראשית ויהי רקיע ותני עלה בראשית בשנים יהי רקיע באחד והוינן בה בשלמא יהי רקיע באחד דתלתא פסוקי הוו אלא בראשית בשנים חמשה פסוקי הוו ותניא הקורא בתורה לא יפחות משלשה פסוקים ואיתמר עלה רב אמר דולג ושמואל אמר פוסק רב אמר דולג מאי טעמא לא אמר פוסק קסבר כל פסוקא דלא פסקיה משה אנן לא פסקינן ליה ושמואל אמר פסקינן ליה והא אמר רבי חנניא קרא צער גדול היה לי אצל רבי חנינא הגדול ולא התיר לי לפסוק אלא לתינוקות של בית רבן הואיל ולהתלמד עשויין התם טעמא מאי משום דלא אפשר הכא נמי לא אפשר.

We therefore assume that just as it is inconceivable that disputes of the Masorah of letters and words were widespread and must instead have been limited to only a small minority of cases, so the disputes in verses must have been very limited in number. To accept the possibility of an error rate of 5% in a matter of Masorah is tantamount to saying that there was no Masorah.

²⁶ The next section discusses whether it is possible to reconcile the discrepancy between 5,888 and our actual number of verses.

²⁷ See e.g. רשש קידושין ל. and גליון השם ברכות ז.

²⁸ E.g. נחלת יעקב מסכת סופרים ט:ג.

²⁹ See e.g. McKay.

Table 2: Actual and Reported³⁰ Counts of פסוקים

		Actual						Total		
פרשת	בראשית	פרשת	שמות	פרשת	ויקרא	פרשת	במדבר	פרשת	דברים	Total
בראשית	146	שמות	124	ויקרא	111	במדבר	159	דברים	105	
נח	153	והארא	121	צו*	97	נשא	176	ואתחנן*	122	
לך-לך	126	בא*	106	שמעני**	91	בהעלותך	136	עקב	111	
וירא	147	בשלח	116	תוריע	67	שלה	119	ראה	126	
חיי שרה	105	יתרו**	75	מצורע	90	קרח	95	שופטים	97	
תולדות	106	משפטים	118	אחרי מות	80	חקת	87	כי תצא	110	
ויצא	148	תרומה	96	קדושים	64	בלק	104	כי תבא	122	
וישלח*	153	תצוה	101	אמר	124	פנחס	168	ניצבים	40	
וישב	112	כי תשא	139	בהר	57	מטות	112	וילך	30	
מקץ	146	ויקהל	122	בחוקתי	78	מסעי	132	האזינו	52	
ויגש	106	פקודי	92					ברכה	41	
ויחי	85									
Actual Sum:	1,533		1,210		859		1,288		956	5,846
Reported Sum:	1,534		1,209		859		1,288		955	5,845

		Reported		
סימן & סימן*	154	סימן & חומש *	סימן & חומש **	96
סימן & סימן* <td>154</td> <td>סימן & חומש *</td> <td>סימן & חומש **</td> <td>96</td>	154	סימן & חומש *	סימן & חומש **	96
		is	says	99
		is	is	91
		99 is clearly a mistake		

³⁰ The “Reported” counts are based on numbers and *simanim* listed in most standard *Chumashim*. In the case of שמות ויקרא, שמואל ויקרא and דברים the פשוט “Reported” numbers do not aggregate to the “Reported” column sum. Ahrend (see section 2) in his discussion of the history of these numbers and *simanim* shows that the “Reported” numbers we have listed above are not all consistent with numbers and *simanim* mentioned in older *sefarim* dealing with this topic.

6. Verses in the Torah

תנו רבנן חמשת אלפים ושמונה מאות ושמונים ושמונה פסוקים הוו פסוקי ס"ת. יתר עליו תהלים שמונה. חסר ממנו דברי הימים שמונה.

Several solutions have been offered to explain the discrepancy between the 5,888 verse count given in the *Gemara* and the 5,845 figure we find in our *Chumashim*.

Answer 1:

R' Yeudah Idel HaLevi Epstein³¹ - Includes Verses from *Tebillim* & DH. R' Epstein explains that 5,888 does not refer to verses in *Chumash* itself but rather to Biblical verses appearing either in Torah or in גן. R' Epstein explains that there are 8 verses in Torah that also appear in *Tebillim* and 35 in Torah that appear in *Divrei Hayamim* (DH). When these 43 are added to the 5,845 of the actual number in *Chumash* it equals 5,888. R' Epstein says his explanation of the missing 43 verses also explains a difficulty in the *Gemara's* ending statement that "*Tebillim* has 8 more and *Divrei Hayamim* 8 less." This statement is problematic because *Tebillim*, with 2,527 verses, and DH with at most 1,765 verses,³² are far smaller than Torah. R' Epstein says the end phrase means that the 5,888 verses in *Chumash* are found by adding the 8 from *Tebillim* to the 5,845 existing verses, and the 35 remaining discrepancy (i.e. 8 less means 8 less than the missing 43)

³¹ Student of R' Chaim Volozhin, cited in *Kasher שלימה*, vol. 28 addenda 12.

³² and Soncino texts of DH have 1,764 verses. *The English Holy Scriptures According to the Masoretic Text* by the Jewish Publication Society of America, as well as Mechon Mamre, has DH with 1,765 verses. The difference hinges on whether DH 1:12:5 is one long verse or 2 smaller verses, i.e.

מ"מ: ה וירמיה ונחזיאל ויוחנן, ויוזבד הגדנתי. ואלעזרי וירימות ובעליה ושמריהו, וישפטיהו
החרפי.

מ"ג: ה וירמיה ונחזיאל ויוחנן, ויוזבד הגדנתי אלעזרי וירימות ובעליה ושמריהו, וישפטיהו
החרפי.

Some English Bibles change verse 4 as well. שי confirms that our reading of verse 4 is correct, but says nothing about verse 5 or 6.

comes from DH. Cohen refutes this interpretation primarily based on the following three issues:

- 1) The correct reading in the text is probably 8,888, not 5,888. Among other arguments he asserts, “It seems obvious that the *baraita* is based on playing with the number 8, and the number 5 spoils this symmetry.”
- 2) There is no good reason to limit the inclusion of additional verses to only *Tebillim* and *Divrei Hayamim* and not from elsewhere in ג.ג.
- 3) The 43 examples are arbitrary. Any set of rules allowing parts of verses will have more than 43 examples; any set of rules limiting the replication to complete verses will have less than 43 examples.

While we find merit with most of the critiques of the answers we have thus far highlighted to all of the questions on *Kiddushin* 30a, we must be careful not to dismiss possible answers because of vague deficiencies. Cohen’s argument that 5,888 is probably wrong because starting the number with a 5 “spoils” the *Gemara’s* symmetry of 8s is too narrowly focused. We will in fact show in a later section that there is a pattern woven throughout this *Gemara* that is satisfied by 5,888 but not 8,888. With respect to Cohen’s objection to treating *Tebillim* and DH differently, it is obvious from the *baraita* that limits the discussion of the middle letter/word/verse and/or verse size to *Chumash*, *Tebillim* and DH, that these כתבי קדש are being treated differently. The question is only why? In trying to answer this question, we would like to point out that these books do not merely repeat phrases from other *Kisvei Kodesh* but indeed repeat entire sections, e.g. compare:

- The 22nd Chapter of Shmuel 2 and the 18th Chapter of *Tebillim*,
- The first 10 verses of DH 2 Chapter 33 and *Melachim* 2 Chapter 21.

While DH, written by Ezra (*Baba Basra* 15a), repeats large parts of מלכים, it at times digresses significantly from the content of *Melachim*. For example, the last half of DH 2 Chapter 33 paints a

favorable picture of Menashe's later years absent in *Melachim*. Abravanel, in his introduction to DH, suggests:

“Jeremiah’s intention in authoring Kings was to record the chronology of the kings, both of Judah and Israel, their righteousness or their wickedness, and the prophecies issued concerning them. Ezra, on the other hand, was interested in the returnees from the Babylonian exile, their lineage, and the kings of the House of David, the forebears of Zerubabel, son of Sheatiel, leader of the Jews at the beginning of the second commonwealth. Since he was the grandson of Jehoiachin, the lineage of the kings is recorded, in addition to their good deeds. Many of these good deeds and exemplary accomplishments are omitted from the accounts in Kings.” (*Judaica Books of the Hagiographa* - Introduction)

We also know from many sources that *Tebillim* (written by David) was held in particularly high esteem (e.g. it too was divided into 5 books). Thus, in Ezra’s time *Tebillim* and DH may well have been the key books that reflect the dawning of a new time and the end of the devastation and punishment visited upon the people because of the evil done during the 1st Temple era.³³

³³ With respect to the core idea that repetitious verses could be added to/deleted from a count, we are open to the possibility that this may be so. גדולות נך מקראות says that there are 1,656 verses in DH and offers an equivalent numerical סימן. However, as previously mentioned, an actual count of DH yields 1,764 or 1,765 verses. The discrepancy of 108 verses (i.e. 1,764 - 1,656) is so great that we find it difficult to believe that it is a simple mistake by a late commentator that went unnoticed by anyone. Rather, we feel it is more likely the result of an old Masorah (see section 2) but have been unable to find the source or the reason for the discrepancy. We offer two numerical solutions that fit the numbers perfectly. However, we are keenly aware that mathematical precision does not guarantee correctness. We leave it to the reader to decide which, if either, solution is more plausible.

1) **The smaller number omits verses in DH that appear in *Chumash* or *Tebillim*.** Below is a list of “Parallelisms for Chronicles 1” (pages 188 and 189) and “Parallelisms for Chronicles 2” (pages 405–407) from *Judaica Books of the Hagiographa*. (Note: No precise definition of “Parallelism” is given.) The chart is presented

to demonstrate that the information given in DH often appears elsewhere. The number of duplicate verses is 108.

<u>Book</u>	<u>Chapter</u>	<u>Number of Verses</u>	<u>Original Book</u>	<u>Specific Verses</u>	
DH 1	1	54	<i>Bereshis</i>	1 through 54	
	2	5	<i>Bereshis</i>	1 through 5	
		1	<i>Shemos</i>	20	
	4	1	<i>Bereshis</i>	9	
	5	2	<i>Bereshis</i>	1,3	
		4	<i>Shemos</i>	27 through 30	
	6	4	<i>Bamidbar</i>	1 through 4	
		2	<i>Shemos</i>	7,8	
	7	2	<i>Bereshis</i>	1,30	
		1	<i>Bamidbar</i>	15	
		16	29	<i>Tebillim</i>	8 through 36
		24	2	<i>Bamidbar</i>	1,2
	DH 2	1	1	<i>Shemos</i>	5

108

- 2 עזרא כתב ספרו ויחס של דברי הימים עד לו מסייעא ליה לרב דאמר רב יהודה אמר רב לא עלה עזרא מבבל עד שיחס עצמו ועלה ומאן אסקיה נחמיה בן חכליה (ב"ב טו).

All of the classical commentators (e.g. Rashi, Tosfos, Maharsha, Maharshal) have difficulty explaining עד לו. Most assume the *Gemara* is saying Ezra wrote some but not all of DH and לו somehow conveys where he stopped. Coincidentally (?) the last 4 chapters in DH (starting with chapter 33 - Menashe) have exactly 108 verses. If 1,656 is a מסורה, it seems plausible that the last 4 chapters of DH were written by נחמיה and not Ezra. Below are the corresponding verses in *Melachim* 2:20:21 – 2:21:1 and DH 2:32:33 – 2:33:1. Note לו in DH 2:32:33 is missing from *Melachim* 20:23. We suggest Ezra stopped with this praise:

מלכים ב כ:כא וַיִּשְׁכַּב חִזְקִיָּהוּ, עַם-אַבְתָּיו; וַיִּמְלֹךְ מְנַשֶּׁה בְּנוֹ, תַּחְתָּיו. **ב כא:א** בְּנוֹ-שְׁתֵּימֵשׁ עֲשָׂרָה שָׁנָה, מְנַשֶּׁה בְּמִלְכוֹ, וְחַמְשִׁים וְחַמֶּשׁ שָׁנָה, מָלַךְ בִּירוּשָׁלַם; וְשֵׁם אָמוֹ, חִפְצִי בָהּ.

ד"ה ב לב:לג וַיִּשְׁכַּב חִזְקִיָּהוּ עַם אַבְתָּיו, וַיִּקְבְּרֵהוּ בְּמַעְלֵה קִבְרֵי בְּנֵי דָוִד, וְכַבֹּד עָשָׂה לוֹ בְּמוֹתוֹ, כָּל יְהוּדָה וַיִּשְׁבִּי יְרוּשָׁלַם; וַיִּמְלֹךְ מְנַשֶּׁה בְּנוֹ, תַּחְתָּיו. **ב לג:א** בְּנוֹ שְׁתֵּימֵשׁ עֲשָׂרָה שָׁנָה, מְנַשֶּׁה בְּמִלְכוֹ; וְחַמְשִׁים וְחַמֶּשׁ שָׁנָה, מָלַךְ בִּירוּשָׁלַם.

Tosfos refutes a similar interpretation of לו. That objection would not apply to our answer.

Answer 2:

*Pardes Yosef*³⁴ - The Double Counting of האזינו

The song in *Haazinu* has 43 verses, and each verse has a סתומה spacing in the middle of the verse that makes each of the 43 verses appear as if it were two verses.³⁵ These “extra” 43 verses raise the total number of verses in the Torah from the actual 5,845 to the *Gemara’s* 5,888. This solution to the 5,888 problem makes no attempt to address the issue of *Tebillim* and DH mentioned at the end of the *Gemara*.

While quite creative, the problem with this “solution” is that the “doubling” effect makes the 43 verses appear as far more than 86 verses. Rambam gives the following rule for the *Shirah* of האזינו:

הלכות ספר תורה ח: **יא** צורת שירת האזינו (דברים לב,א-מג)--כל שיטה ושיטה, יש באמצעה ריוח אחד כצורת הפרשה הסתומה, ונמצאת כל שיטה חלוקה לשתיים; וכותבין אותה בשבע ושישים שיטות. ואלו הן התיבות שבראש כל שיטה ושיטה: האזינו, יערף, כשעירם, כי... וכפר.

Below is a sample of how the first few verses appear in the *Sefer Torah*. Note that whereas the first verse, starting with האזינו, appears on the first line with a significant spacing gap after ואדברה, the second verse, starting יערף, is spaced on 2 full lines. In total

ותשמע הארץ אמרי פי תזל כטל אמרתי כרביבים עלי עשב הבו גדל לאלהינו כי כל דרכיו משפט	האזינו השמים ואדברה יערף כמטר לקחי כשעירם עלי דשא כי שם ה' אקרא הצור תמים פעלו
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³⁴ At the beginning of *Haazinu*. Also mentioned in Satmar Torah journal *Pri Eitz T'morim, Tishrei* 5743 issue, #221.

³⁵ This is called “*ariach al ga'bei ariach, l'veinoh al ga'bei l'veinoh*.”

as Rambam writes, the 43 “real” verses are spread out over 67 lines.³⁶ Thus, if we were counting each line as 2 verses we would have 134 (not 86 verses) and if we simply count each line once, we have 67 verses.

7. *Zohar*- 600,000 Letters in the Torah

One additional tangential citation relating to the issues raised in *Kiddushin* 30a is the following *Zohar*:

פרשת כי תבא : אלף בית גימל דלת הא וו זין חית טת יוד כף למד ממ נון
סמך עין פא צדי קוף ריש שין תו אלין אינון סליקו דאתוון לשיתין רבוא
בגין למהוי שלימו ברזא דאתוון בשייפי כולהו.

According to the *Zohar* the letters of the Hebrew alphabet in the Torah are cumulatively 600,000 and mirror the size of the Jewish people when they left Egypt. As mentioned in a previous section and as delineated in Appendix A, there are less than 305,000 letters in the Torah. Why then does the *Zohar* say 600,000? Many solutions have been suggested for this question and most have elements of commonality. We conclude this section of the paper with a brief description of the many explanations of this comment in the *Zohar*.

Answer 1:

Rav Yaakov Kaminetsky (R' K)³⁷ - *Zohar* Means Horizontal Space, not Letters. R' Kaminetsky proves from the following Rambam that different letters take up different amounts of horizontal space and it is this spacing, not the letters, that the *Zohar* is counting:

הלכות ספר תורה זו: ... נזדמנה לו בסוף השיטה תיבה בת עשר
אותיות, או פחות או יתר, ולא נשאר מן השיטה כדי לכתוב את כולה

³⁶ *Hakirah* Vol. 3 (Summer 2006) “Letters to the Editor” (page 8) has a fascinating story of the Aleppo Codex and this Rambam. The number 67 was incorrectly changed in Rambam to 70 and the authenticity of the Codex was challenged.

³⁷ Last piece in אמת ליעקב on *Chumash*.

בתוך הדף--אם יכול לכתוב חצייה בתוך הדף וחצייה חוץ לדף, כותב;
ואם לאו, מניח המקום פנוי ומתחיל מתחילת השיטה

Since there are no words in the Torah that have more than 10 letters but there are words that take up more than 10 spaces, R' Kaminetsky concludes that Rambam must be referring to spaces, not words. R' Kaminetsky considers the יוד the smallest unit of horizontal width, and offers a width measurement for each letter in terms of the standard *yud*. The details of this approach are given in the 3rd and 4th columns of Appendix A. In this scheme, the total amount of needed space is the equivalent of 576,442 *yud*'s. A slight variation of the letter-*yud* relationship could make this number closer to 600,000.

Answer 2:

אברהם אזולאי (RA) - Use the Number of Letters in the Spelling of the Letter. For example, the letter א counts for 3 since it is spelled אלה. The 5th and 6th columns of Appendix A give the associations and final numbers based on the spelling of the letters as given in the *Zohar*. The final answer of 803,401 is considerably off the mark.³⁸

³⁸ The details of this technique are given by R' Margalioth in המקרא והמסורה (p. 41). R' Azulei's grandson, the חידא, said he could not get his grandfather's solution to work. What we have presented here is really a modification of his solution. Based on his spellings, the final answer would be 2,043,781, far worse than our result. One other variation of the first 2 solutions is given by the רא"ם (see המקרא והמסורה page 43), who notes that many letters are combinations of other letters. For each letter he suggests you use the number of letters contained in its written form. E.g.:

א

is made of 3 distinct letters: an upper *yud*, a lower *yud*, and a body like a *vov*. It would then be counted as 3. R' Uri Dasberg uses a similar scheme (see <<http://64.233.167.104/search?q=cache:zbJUXLg6FDIJ:www.seliyahu.org.il/parasha/par5763/epar63036.rtf+letter+304801+%22torah%22&hl=en&ct=clnk&cd=5&gl=us&ie=UTF-8>>) and comes up with "only" 539,996 letters. He adds 59,951 because of end-of-word letters that are of a special form (i.e. *mem*, *nun*, *tzadi*, *peh*, *chaf*) and a final 53 by including the specially marked letters in the Torah, i.e. 32 letters that have dots over them, 10 large letters, 6 small letters, and

Answer 3:

פני יהושע - Roughly 300,000 letters in מקרא and 300,000 letters in *Targum*.

Answer 4:

פני יהושע - Each letter has a reading and a pronunciation.

Answer 5:

מרגלית הים - Includes spaces between letters, words, פתוחות, סתומות. R' Margalioth does not offer a detailed analysis to show that if the number of blank spaces in the Torah were used they could accommodate an additional 295,000 letters.

8. Introducing a Plausible Solution Framework

In the previous sections we went through each line of *Kiddushin* 30a, stated the problems and reviewed suggested solutions. The solutions offered were disconnected in that each responded to a separate problem and most solutions resolved only a single problem. As we also pointed out, the solutions generally involved the limiting of the text to certain specific sub-classes of letters and words (e.g. large letters, double words...) without any indication from the *Gemara* what the sub-class was or why the information being discussed was important. In this section we attempt to outline an approach that will answer all of the questions. Many of the points that we will be using have come up previously in the context of other solutions but will be

5 letters that are always placed at the top of a page. After exactly reaching the target 600,000, he concludes, “How is it that we succeeded in this calculation, when all the previous generations failed? It is not because we are smarter or because our Torah scrolls are more accurate than theirs. It is rather due to the fact that we have computers, while our predecessors had to sit and think. Once they laid the foundation with the reason for this task, we continued as midgets sitting on the shoulders of giants, and we can see for a much larger distance.”

used here in a different way. We will try to show why the issues we are discussing are important and where there is evidence in the *Gemara* to support our position. While we will not definitively answer every question previously asked, further analysis will hopefully show how these observations will lead to a better understanding of the remaining issues as well.

Of all of the authors previously cited, only Merzbach (Section 4) attempted to offer a palatable rationale for the *soferim* highlighting the things they did, i.e. to help check the correctness of a handwritten Torah. This reason takes the *soferim* out of the category of “metaphysical theorists” all the other authors make them out to be, and brings them into the realm of concerned practitioners. This transformation makes us view anything that they say in a different light. We would like to take the discussion beyond Merzbach and focus on the physical properties of the *Sefer Torah*. By physical properties we are not referring to slight differences in spelling between *Ashkenazic* and *Sepharadic* S”T or the differences in verses or words that we have previously mentioned. These changes involve elements of faulty Masorah on the part of one or both traditions. Rather, we are referring to tangential issues like the differences between *Ashkenazic* S”T that are wrapped around two wooden עצי חיים by which they are lifted, and *Sepharadic* S”T where the *atzrei chaim* are encased in a box and carried that way. Both styles of S”T are acceptable and each represents a different approach to what is “better” or “more proper.” According to *Midrash Rabbah*,³⁹ *Hashem* gave the Torah to Moshe and Moshe gave each of the tribes a *Sefer Torah* on the day of his death. What did these *Sefrei Torahs* physically look like, and how did they compare with the one we have today? Are we to assume that the “look and feel” of the *Sefer Torah* has remained constant over the more than 3,300 years of its existence? Or, as in most things in life, can we assume that changes have occurred, for whatever reason, in style and look over these many years? Below is a brief review of three major changes in *Sifrei Torah* that are highlighted in the *Gemara*, *Baraisos*, *risbonim* and *acharonim*. We will explain each of these changes and attempt to show how they can help us begin to understand *Kiddushin* 30a.

³⁹ At the end of וילך ע”א. וילך מ”ק יו”ד סימן ע”א. does not mention this midrash and says that upon Moshe’s death, in all there was only one *Sefer Torah*.

a) Ezra Changed the Lettering System from *Ivri* to *Ashuri*

סנהדרין כא:- אמר מר זוטרא ואיתימא מר עוקבא בתחלה ניתנה תורה לישראל בכתב עברי ולשון הקודש חזרה וניתנה להם בימי עזרא בכתב אשורית ולשון ארמי ביררו להן לישראל כתב אשורית ולשון הקודש והניחו להדיוטות כתב עברית ולשון ארמי מאן הדיוטות אמר רב חסדא כותאי מאי כתב עברית אמר רב חסדא כתב ליבונאה.

Ivri script⁴⁰ is considerably different from *Ashuri* in size and shape of the letters. Thus, it was about 1,000 years after the giving of the Torah on Sinai that regular *Sifrei Torah* were first written in the current script that we have. Up until then the letters (pronunciation), words and verses were the same but the form of the written letters was different.

b) Wooden Rollers and Blank Space

In discussing the different requirements of a *Sefer Torah*, the *Baraisa* writes:

ב"ב יג:-ת"ר הרוצה לדבק תורה נביאים וכתובים כאחד מדבק ועושה בראשו כדי לגול עמוד ובסופו כדי לגול היקף ...
רשי ד"ה כדי - מניח קלף חלק לגלול על גבי עמוד של עץ שהספר נגלל עליו.

⁴⁰ Below is a chart of 5 different Hebrew scripts successively: *Ashuri*, Cursive, Rashi, Printed and *Ivri*.

א ב ג ד ה ו ז ח ט י כ ל מ נ ס ע פ ק ר ש ת
א ב ג ד ה ו ז ח ט י כ ל מ נ ס ע פ ק ר ש ת
א ב ג ד ה ו ז ח ט י כ ל מ נ ס ע פ ק ר ש ת
א ב ג ד ה ו ז ח ט י כ ל מ נ ס ע פ ק ר ש ת
א ב ג ד ה ו ז ח ט י כ ל מ נ ס ע פ ק ר ש ת

ד"ה ובסופו - בסופו מניח חלק גדול כדי לגול בו כל הקיפו שאין עושה שני עמודים לגול לו לאמצעו כמו שאנו עושים לספר תורה אלא גוללו מתחילתו לסופו וכורך החלק על כל ההיקף.

Rashi explains that unlike our *Sifrei Torah*, which have wooden rollers at both ends and are closed by rolling toward the middle, in prior times⁴¹ there was a single wooden roller at the beginning and the S"Y were closed by rolling the beginning (right side- בראשית) toward the end. Rashi also explains that the side that had no roller must have a greater amount of blank parchment that wrapped around the written part when it is rolled up. Tosfos, ד"ה ועושה, disagrees with Rashi as to which side the roller is placed on a *Sefer Torah*, i.e. the single roller was at the end of the *Sefer*, not the beginning, and that the empty parchment was at the beginning, not the end. When exactly did this change from one roller to two rollers take place? We can perhaps pin the time of the change down based on the following conflicting three *Baraisos*:

מסכת ספר תורה ב:ה... ובתורה לא נתנו שיעור אלא עושה עמוד⁴²
בסוף הספר ואינו צריך לעשות כן⁴³ אלא בתחילתו.
מסכת סופרים ב:ה... מניחין אותו בסוף הדף כדי להקיפו עושה עמוד בסוף
הספר בתחילה כדי להקיפו וא"צ לעשות כן בתחילתו ובתורה מכאן ומכאן
לפיכך גוללין הספר לתחילתו ולתורה לאמצעית.

⁴¹ This is our understanding of Rashi. ArtScroll interprets the phrase in the second Rashi "כמו שאנו עושין לס"ת" not to differentiate between "us" (i.e. now) and "them" (i.e. in the past) but between S"Y and other books. According to this view, Rashi never said that any S"Y ever had 1 roller. We reject this view because:

- It is not the simple meaning of Rashi's words.
- Rashi ב"ב יד: ד"ה ספר העזרה לתחילתו *Sefer Torah* Moshe wrote and that was in the עזרה had but a single roller on the right.

⁴² Tosfos ב"ב יג: bases part of his disagreement with Rashi on this and similar *Baraisos* that seem to say that the roller was at the end of the *Sefer Torah*.

⁴³ Several words (e.g. בתחילה, אלא ...) in this and the next *Baraisa* are problematic. Nevertheless, they clearly demonstrate that at one time a S"Y had one *yad* and at another time had two.

ב"ב יד...רב אשי אמר כי תניא ההיא בספר תורה כדתניא כל הספרים נגללים מתחלתן לסופן וס"ת נגלל לאמצעיתו ועושה לו עמוד אילך ואילך.

i.e. the first says that a S"t has one roller while the other two say that it has two. The first citation is from *Maseches Sefer Torah* and was written in Israel before the redaction of the Mishnah. The second citation is from *Maseches Soferim*, which is a work of the Gaonic period and dates to somewhere in the middle of the eighth century.⁴⁴ Rav Ashi's reference is to a *Baraisa* of unknown origin. Thus, the transition from a single roller to a double roller seems to have occurred somewhere between the end of the *Tannaic* period and the 8th Century. This would place this change, 500 years, or more, after Ezra's changing of the script.

c) ווי העמדים – From Shunned to Desirable

The *Gemara* and Rambam list a number of items that are desirable in a S"t but even if missing do not affect the usability of the *Sefer*. Rambam concludes that there are also הידורים that are desirable that are not listed in the *Gemara*:

הלכות ס"ת ז:ט כל הדברים האלו, לא נאמרו אלא למצוה מן המובחר; ואם שינה בתיקון זה, או שלא דיקדק בתגין, וכתב האותיות כולן כתקנן, או שקירב את השיטין, או הרחיקן, או האריך בהן, או קיצרן--הואיל ולא הדביקן אות לאות, ולא חיסר ולא הותיר, ולא הפסיד צורת אות אחת, ולא שינה בפתוחות וסתומות--הרי זה ספר כשר. ז"י יש דברים אחרים, שלא אמרו אותן בתלמוד--נהגו בהם הסופרים, וקבלה היא בידם איש מפי איש; והן: שיהיו מניין השיטין שבכל דף ודף, לא פחות⁴⁵ משמונה וארבעים, ולא יתר על ששים; ושיהיה הריוח שבין כל פרשה ופרשה, כמו תשע אותיות אשר אשר אשר...וכל הדברים האלו, למצוה מן המובחר; ואם שינה, לא פסל.

⁴⁴ See, e.g. Soncino Introduction to מסכתות קטנות.

⁴⁵ This is the correct reading according to Mechon Mamre (see <<http://www.mechon-mamre.org/>>) and *Hagaos Maimones*. מעדני יום טוב et al say that based on סופרים ב:ו the correct text should read 42 (not 48). מסכת ספר תורה offers nothing on this issue.

Sometime after Rambam, the issue of having a S”T that started with a *vav* on every page became a heated matter of discussion. Some early *poskim* were vehemently against this custom and considered banning any S”T so written:

הגהות מיימיניות ז:ט:ז- מה שנהגו סופרים בורים להתחיל כל עמוד בו”ו וקורין לו וו”י העמודים ופעמים יש אותיות גדולות אשר לא כדת שמסדרה בספר העתקה המתוקין לכך עמודים רחבים ביש מקומות וכותבין עליו רחב ויש מקומות קצרים וכותב עליו קצר ופעמים אותיות משונות וארוכות הרבה כדי שיגיע וי”ו לראש... והנה כתבתי דברי אלה למורי רבינו והסכים על ידי וז”ל” אשר השיבני ושאלת על ספר תורה בווי העמודים ולא נכון בעיני כמו שכתבת ואינם לא מדברי תורה ולא מדברי סופרים אך סופר אחד היה ר’ ליאונטין ממלהוון שהראה אומנתו ואילו היה לי לכתוב ס”ת הייתי נזהר שלא היה שום עמוד מתחיל בו”ו חוץ מואעידה במ עכ”ל.

Eventually, the opposition to such a *Sefer Torah* ceased:

ערוך השולחן יו”ד רעג:כד ובדבר ווי העמודים יש רבים וגדולים מראשונים ואחרונים שצעקו בכרוכיא על זה שע”י זה מקלקלים כל העמודים בשינוי האותיות לפי שצריכים לשער שיבא וי”ו בראש כל עמוד אמנם זה זמן רב שיצא לאור תיקון סופר אחד יפה אף נעים מסודר על וווי העמודים בלי שום דחיקת אות וכבר נהגו הסופרים לכתוב אחריו ובוודא יש נכון וישר לעשות כן ויש בזה ענין גדול.

With someone eventually mastering the writing of such a S”T without the drawbacks listed by *Hagaos Maimones* (H”M), what was once to be avoided has now become the norm. Most of our S”T today follow the *Vavei H’Amudim* format. These S”T have 42 lines per page and are 245 pages in length. The 42 lines per page is less than the minimum 48 lines recommended by Rambam.

In conclusion, today’s S”T do not in any way look like S”T of over 2,500 years ago. Our S”T use a different script (*Ashuri*, introduced 2,300 years ago), have rollers on both sides (introduced less than 1,800 years ago) and have *vav*’s starting almost every page (introduced less than 300 years ago).

9. Consequence of Change—Designing a New *Sefer*

The first item of change highlighted in the last section was the changing of script from *Ivri* to *Ashuri*. המקרא והמסורה (p. 31) offers the following motivation for the change:

ובכן דעת מר זוטרא כי משה איש הא' בכתבו עלי ספר דברי התורה השתמש בשתי הסגולות המקדשות אך בספר שהניח בארון העדות ובספרים שנתן לשבטי יה. כאשר היה על הלוחות הכתובים באצבע א'. אבל ספרי תורה שניתנו להעם להגות בהם היו בלשון הקדש וכתב עברי עד שנשכחו מהם אותיות" מנצפ"ך כי בתורת הראשונים לא היה מ"ם שלהם סתומה... לכן עמד עזרא ותיקן כי כל ספרי תורה יכתבו בהכתב המקודש העתיק.

Whatever the motivation, it is quite obvious that the changes in script also affected the "layout" of the Torah. As we have seen previously, it was very important that the Torah be written neatly with no untoward lengthening or shortening of letters because of space restrictions or availability. Undoubtedly it was old S" T written by recognized experts that served as templates for newer *Sefarim* and *soferim*. However, while older *Sefarim* certainly are a helpful guide in making a new *Sefer*, they by no means resolve all design problems. For example, Rambam in *Hilchos Sefer Torah* writes:

ט:א אין עושין ספר תורה, לא אורכו יתר על היקפו, ולא היקפו יתר על אורכו. וכמה הוא אורכו: בגוויל--שישה טפחים, שהם ארבע ועשרים אצבע ברוחב הגודל של יד; ובקלף--או פחות או יתר, והוא שיהא אורכו כהיקפו. וכן אם עשה בגוויל פחות משישה ומיעט את הכתב, או יתר על השישה והרחיב בכתב, עד שיהיה אורכו כהיקפו--הרי זה כמצוה.

The *Gemara* comments that making a S" T with equal circumference and height is no easy task:

רב הונא כתב שבעין ספרי דאורייתא ולא איתרמי ליה אלא חד רב אחא בר יעקב כתב חד אמשכיה דעיגלי ואיתרמי ליה יהבו ביה רבנן עינייהו ונח נפשיה אמרו ליה רבנן לרב המנונא כתב רבי אמי ד' מאה ספרי תורה אמר להו דילמא (דברים לג) תורה צוה לנו משה כתב.

Rambam in the 9th chapter tries to remedy the situation by offering details on how to construct such a *Sefer Torah*. He ultimately reports:

ט:י ספר תורה שכתבתי אני--רוחב כל דף ודף מדפיו, ארבע אצבעות; ושירת הים ושירת האזינו, רוחב כל דף משתיהן שש אצבעות; ומניין השיטין שבכל דף ודף, אחת וחמישים; ומניין הדפין של כל הספר, מאתיים שישה ועשרים דף; ואורך כל הספר, אלף ושלוש מאות ושישים ושש אצבעות, בקירוב.

However, *Hagaos Maimones* after following Rambam's instructions reports:

הנה אני עשיתי בספר תורה שכתבתי בכל המידות האלה ולא איתרמי לי.

Considering all of the above, the introduction of a new script in the time of Ezra with different-size letters made all existing S”T templates obsolete. In Section 1 we identified the *rishonim* of *Kiddushin* 30a as very early *Chachamim* most likely dating to the time of Ezra. But why would these *Chachamim* specifically be designated *rishonim*, firsts? There were certainly *Chachamim* before them as well. We suggest that “*rishonim*” refers to the first *Chachamim* who had to deal with the new S”T and developed a methodology to guide the scribes in their work. We will now begin to demonstrate how the assertions about middle letters, words and verses achieved this goal

Table 3 lists the three verses mentioned in *Kiddushin* 30a and how many verses precede them in our current *Sefer Torah*.

Table 3

Number of פסוקים Preceding Given Midpoints

<u>Property</u>	<u>Preceded in the Torah by the Number of פסוקים listed below</u>
Middle Word - ויקרא י:טז	2990
Middle Letter - ויקרא יא:מב	3036
Middle פסוק - ויקרא יג:לג	3082

A critical point not recognized by anyone to date is that each of the numbers in Table 3 is exactly 46 פסוקים after the one that precedes it, and that all three numbers are divisible by 46. As a point

of information, none of the actual 3 “middle” verses generate numbers of this type that are divisible by 46. From a mathematical perspective the likelihood that 3 “middle” verses would all be divisible by 46 is less than one tenth of 1%. Thus the overwhelming likelihood is that this arrangement is by design.

In terms of the total number of verses in *Chumash*, Table 4 below lists all possible alternative counts that have been offered by a variety of sources, and shows that only 5,888 used in the *Gemara* and 5,842 suggested by ⁴⁶זית רענן are divisible by 46. The fact that divisibility by 46 is generally uncommon but occurs here in Table 4 according to some גרסאות, as well as in all three previous middles in Table 3, indicates that divisibility by 46 is by design, not coincidence. The question is: What is the design?

Table 4

Number of פסוקים in the Torah

<u>Number of פסוקים In Torah</u>	<u>Source</u>	<u>Divisible by 46</u>
8,888	Cohen	No
5,888	קדושין ל. in ברייתא.	Yes
5,846	Actual number in our current Torah.	No
5,845	חומשים: Number listed in back of all ילקוט פי עקב.	No
5,842	זית רענן by קידושין ל. Given in a gloss on	Yes

From our previous discussion about constructing a S”T, it is apparent that “writing” a *Sefer Torah* involves more than making sure that all the words are spelled correctly and no words are missing. The writing of a *Sefer Torah* also has a design component where the writing is intended to satisfy some other objective, e.g. outward symmetry where the height of the *Sefer Torah* equals its circumference; inner symmetry where every page starts with a *vav*. And, as we have also seen, these objectives can and do change with time. We suggest that

⁴⁶ See lower-right-hand gloss in *Gemara*. It is a commentary on ילקוט by מגן אברהם.

divisibility by 46 can be used to design a ספר תורה that possesses several desirable qualities. Firstly, this S”T will be symmetric in the sense that there are exactly the same number of verses on each page.⁴⁷ While verses vary in number of words, the number of verses per page is large enough, 46, that overall each page should roughly have about 630 words, i.e. 46×13.7 (Average number of words per verse— $79,980/5,845$). In this way, variability in the number of lines per page, or width of the page to accommodate a variable number of words, should be able to be kept to a minimum. Secondly, outside of visual symmetry, having a S”T with an equal number of verses per page means that any verse can be easily found, i.e. dividing the number the verse is in the Torah by 46 will immediately dictate which page it is on. For someone with little recognition of verse content, this property can significantly diminish search time for the verse. In a S”T constructed this way, the three verses identified in the Gemara as midpoints would respectively appear at the top of pages 66, 67 and 68. In terms of the number of pages in the entire *Sefer Torah*, Torahs with 5,888 and 5,842 verses would respectively have exactly 128 and 127 pages. We suggest that when the *Baraisa* says that the Torah has 5,888 verses, it is not claiming that it actually has this number, but rather that it should be treated as if it had this number. To this end, note that the *Gemara’s* language is “5,888 verses are the verses of the S”T.” The stress here is not on how many verses there are in the Torah, but rather in the S”T. If the *Sefer Torah* is designed to accommodate 5,888 verses with the intention of each page having 46 verses then, as described above, it would fill exactly 128 pages. Since the Torah in fact has only 5,845 verses,⁴⁸ the completed S”T will have 127 complete pages of 46 verses in length, with a total of 5,842 verses (i.e. 127×46), and the last page will have the last 3 verses. Although these verses do not require a full page of space, whatever is on the last page is stretched out to take up the entire page (see י”ד (רעב:ג). Thus, in effect this S”T has 128 complete pages. We further suggest that ז”ת רענן, who said there are 5,842 verses, is not challenging the actual number of 5,845, but rather giving the number

⁴⁷ Page is being used to represent דף. The parchment leaves that are sewn together to create a *Sefer Torah* each have between 3 and 8 דפים.

⁴⁸ We will use 5,845 although we have elsewhere discussed that it may be 5,846.

that are on fully completed pages,⁴⁹ omitting the last page with its 3 verses.

To validate our explanation of the *Sefer Torah* design, we must address the question of why the *Gemara* says that the verse midpoint of this *Sefer Torah* is on top of page 68. Since the entire *Sefer Torah* is 128 pages, the midpoint⁵⁰ should be verse 2,945, which is on top of page 65. Our first thought is to attribute the extra pages to the blank pages needed at the end to wrap around the circumference of the S”T. To make *והתגלה* the middle verse implies that there are a total of 134 pages (i.e. $67*2$) in the S”T, when in fact it has only 128. If the extra pages are due to the need for blank pages to wrap around the S”T, that would mean that 6 blank pages are needed to do the job. Is there any evidence that this is a reasonable number of pages? We think there is.

הלכות ספר תורה ט: א אין עושין ספר תורה, לא אורכו יתר על היקפו, ולא היקפו יתר על אורכו. וכמה הוא אורכו: בגוויל--שישה טפחים, שהם ארבע ועשרים אצבע ברוחב הגודל של יד; ... ו ואחר שכותב הדף שבדוק בו לפי מה שירצה, ימוד רוחב הדף באצבעות הכנה; ויוסיף על רוחב הדף שתי אצבעות שבין דף ודף, ... ספר תורה שכתבתי אני--רוחב כל דף ודף מדפיו, ארבע אצבעות; ושירת הים ושירת האזינו, רוחב כל דף משתיהן שש אצבעות...

Rambam says the height of a S”T is 24 אצבעות; the page width of the S”T he personally made was 4 *etzbaos* (for all but 2 pages); each page has an extra 1 *etzba* margin on both sides. Since Rambam claims to have satisfied the requirement that the S”T height and circumference be about equal, the amount of parchment necessary to wrap around his S”T (i.e. its circumference) must have

⁴⁹ Alternatively, if he counted the 10 Commandments based on העליון, the total number of verses would be just under 5,842 (i.e. 5,846 less 6—see footnote in Table 2) and he was giving the number of full pages in the S”T.

⁵⁰ This section discusses the significance of 46, why the identified letter, word and verse are significant and why *והתגלה* is the middle verse. Later we will address why the letter and words are midpoints and why 46 was the chosen number.

been approximately 24 *etzbaos*. Since the width of each page is 4 *etzbaos*, this equals 6 blank pages with no margin or 4 full pages (with double margin—see Appendix B for an in-depth mathematical analysis of Rambam’s S”T and a calculation of how thick his parchment was). We must of course point out that Rambam’s S”T and the one we are discussing are not identical in shape. Firstly, his has 2 *atzei chaim* and the one we are discussing has 1. Also, the S”T we have described above is a little more than half the page length of the Rambam’s. This could be accomplished by either making the pages twice as wide, doubling the height, or a combination of both. These shifts could very well increase the number of blank pages needed to both cover the *Sefer* and at the same time make the circumference equal the height. Therefore, our conjecture that the *soferim* meant to have 6 blank pages at the end is a distinct possibility.⁵¹

In summary we are suggesting that the *soferim* in *Kiddushin* 30a designed:

- A 134-page *Sefer Torah*, with
- A single עץ חיים at the front end, where
- The first 127 pages have 46 verses,
- The 128th page has 3 verses, and

⁵¹ Additional clarification on this issue appears in a later section. We would also like to point out that the concept of equalizing the circumference and height of a S”T is mentioned in ספר תורה ב:י but not in סופרים. As previously cited, the *Gemara* in *Baba Basra* stressed that few were able to achieve this objective, and H”M says he could not duplicate Rambam’s accomplishment. We also mentioned earlier that *Masachot Sefer Torah* is a pre-Mishnaic work written when a S”T had a single *etz chaim*, and *Masechet Soferim* is a later Gaonic-period work written in the 2-*atzei-chaim* era. We therefore conjecture that the desirability of equalizing height and circumference may have been a goal more easily accomplished in earlier times when a rolled up S”T formed a circle, and making the S”T higher and thinner could have allowed equality by adding enough blank pages at the end to equalize the difference. By the time of the *Gemara* and 2 *atzei chaim*, a rolled-up S”T resembled an ellipse, and manipulating equality of circumference and height became nigh impossible. See Rashash *Baba Basra* 14b for a discussion of the difference in the circumference of a one- and a two-*atzei-chaim* S”T.

- The 6 final pages are left blank.

We conclude this analysis with one final clarifying point. Every number that we have indicated is divisible by 46 is also divisible by 23. Thus if we made a Torah with 23 verses per page, it too would have all three highlighted verses on the top of a page, and each verse would be 2 pages removed from the next one. This S”T would have 256 pages and be almost equal in size to our current S”T that have 245 pages. How then can we tell if the *Gemara* meant to divide by 46 or 23? The answer is quite straightforward. Had 23 been the operative divisor, the *Gemara* would have said that the Torah had 5,865 verses, i.e. the next higher number after 8,542 divisible by 23, and the last page would have accommodated the last 3 verses. It is only if we divide by 46 that 5,865 does not suffice and we require 5,888. Thus the Torah that we say the *Gemara* is describing is one that is about double the size in height as ours and half the length. Since we are describing a S”T with a single *etz chaim* at the starting point, as we have discussed before, after use the S”T will be rolled up toward its end. Thus, if the next usage of the S”T is a reading in *Beresbis*, the entire 134 pages will have to be rolled in order to get to the correct spot.

Our explanation of the meaning of middle verse also addresses the question we previously raised as to why R’ Yosef asked: **מהאי גיטא או מהאי גיטא**? i.e. an even number of verses has two middle verses and an odd number of verses has a unique middle verse. Moreover, if there are an odd number of verses, checking a S”T would tell you nothing. Our answer is that he understood, from the fact that the *soferim* mentioned a single middle verse, that it must be on either the bottom of the last page of the first half (**מהאי גיטא**) or the top of the first page of the second half (**מהאי גיטא**). This is a logistical question and certainly appropriate. The answer then was to count the verses and see if it is verse 3,082 (bottom of the page) or verse 3,083 (top of the page).

A S”T constructed in the way we have described would have an additional interesting property. By starting each page with a new verse, the likelihood that the first letter on each page is a *vav* is greatly increased. This is so because the letter *vav*, although representing only a little more than 10% of the letters in the Torah (i.e. 30,509 out of 304,805—see Appendix A), nevertheless is the first letter in about

72% of the verses in the Torah.⁵² Table 5 shows the verse and letter on top of each page in בראשית⁵³ assuming that each page has exactly 46 verses. Of the 34 pages, 27 (79.4%) start with a *vav*; 3 start with an א; and ב, ט, י and ל start one each. If this is how the original *Ashuri S”T* were designed, then the ultimate idea of having a *vavei haamudim S”T*⁵⁴ could have been the result of wanting to expand the starting *vav*'s to 100% of the pages, i.e. for *Bereshtis* eliminate 6 of the 7 non-*vav*'s.⁵⁵ On the other hand, if original S”T were not based on a fixed number of verses per page, any word in the middle of a verse could start the page, and the likelihood that the majority of pages start with a *vav* is greatly diminished. I.e. since 4,194 of the 5,845 verses start with a *vav*, *vav*'s are only 8.8% of letters that do not start sentences (26,315 out of 299,837). Since a S”T has approximately 80,000 words, even if every *vav* appeared at the beginning of a word (which it does not), *vav*'s could not make up more than 1/3 of the words in the Torah not starting a verse.⁵⁶ In this system, very few of the pages would randomly start with *vav*'s, and it is difficult to understand how the *vavei haamudim* concept originated.

⁵² The frequency of a verse starting with a *vav* decreases from book to book, i.e. בראשית- 84.5%, שמות- 78.8%, ויקרא- 72.9%, במדבר- 67.2% and דברים- 47.5%.

⁵³ We have not worked this out for the other *Chumashim* in Torah but are confident that they will produce the same overwhelming percentages of starting *vav*'s.

⁵⁴ Other than the catchy name we have seen, no motivation is given for having a *Vavei H’Amudim Sefer Torah*.

⁵⁵ I.e. the first letter on the first page must be a ב. In all, a 46-verse page yields a 128 page S”T with approximately 92 pages starting with a *vav*. The objective would then be to make the entire *Sefer* uniform and eliminate most of the 36 non-*vav*'s. In our current S”T 6 pages start with letters other than *vav*.

⁵⁶ In our S”T, 63% of the pages start with a *vav* that does not start a verse. We find this percentage surprisingly high. Perhaps that is why it took so long to develop such a S”T.

Table 5

First Letter on the Top of Each Page in בראשית

Starting A New Page Every 46 Verses

<u>Page</u>	<u>Verse</u>	<u>Letter</u>	<u>Page</u>	<u>Verse</u>	<u>Letter</u>
1	1:1	ב	18	28:09	ו
2	2:16	ו	19	29:33	ו
3	4:13	ו	20	31:1	ו
4	6:1	ו	21	31:47	ו
5	8:1	ו	22	33:6	ו
6	9:25	ו	23	35:1	ו
7	11:10	א	24	36:18	ו
8	13:4	א	25	37:21	ו
9	15:8	ו	26	39:1	ו
10	17:17	ו	27	41:1	ו
11	19:3	ו	28	41:47	ו
12	20:11	ו	29	42:36	ו
13	22:5	ו	30	44:10	ו
14	24:7	י	31	45:22	ל
15	24:53	ו	32	47:6	א
16	25:32	ו	33	48:21	ו
17	27:09	ט	34	50:12	ו

In summary, we are suggesting that our count of 5,845 verses is accurate and not challenged by any part of the *Gemara*. In fact, the 3 cited verses are divisible by 46 only if the first 3,082 verses in the Torah as we have them are correct. It is this correct count that

validates⁵⁷ all of the calculations and helps accomplish the *Gemara's* objective of getting the highlighted letter, word and verse of interest on the top of a page.

The significance of the number 46 is not limited to the five books of the Torah. Further evidence of the significance of divisibility by 46 is found in the *Gemara's* statement that תהלים עה:לח (i.e. והוא רחום) is the middle verse of the 2,527 verses. In fact, תהלים עה:לו which is the 1,264th verse, is the middle verse, i.e. two verses earlier. However, note that 2,527 is not divisible by 46. If, as we did in Torah, we are looking for pages that contain 46 verses, then the number of pages to accommodate the 2,527 verses of *Tebillim* is 55 (since $46 \times 55 = 2,530$). The 55 pages will accommodate 3 more verses than *Tebillim* has, according to our count. Thus 2,484 verses will be on the first 54 pages and 43 verses on the last page. The verse the *Gemara* offers as the middle verse, והוא רחום, is preceded in תהלים by 1,265 verses. Thus, the *Gemara's* verse (verse 1,266) starts exactly at the middle of page 28 and is in fact the middle verse of the complete 2,530 verses that could be accommodated on the 55 pages of *Tebillim*.^{58,59}

We conclude this section with the final statement in the חסר ממנו דברי הימים שמונה: ברייתא. The back of all standard D'H texts says it has in total 1,656 verses, but an actual count shows 1,764 verses.⁶⁰ Note that 1,656 is divisible by 46 but 1,764 is not.

⁵⁷ I.e. if in fact there are an extra 43 verses, they must all come in the final 2,806 (35%) of the Torah. This is highly unlikely.

⁵⁸ We are not assuming any extra pages added on one side for the sake of wrapping around the rest of the *Sefer*. *Maseches Sefer Torah* 2:5 appears to say that a S"Y requires a single *etz chaim* and other books require none.

⁵⁹ The only verse highlighted in the *Gemara* lacking divisibility by 46 is *Tebillim* 80:14, which is said to contain the middle letter of *Tebillim*, i.e. the ע of יער. This verse is preceded by 1326 verses. 1326 is not divisible by 46, and if we divided pages into blocks of 46 verses, *Tebillim* 80:14 would be 8 verses before the bottom of page 58. We have no explanation for why this verse was highlighted. However, we wonder whether this is the meaning of the end of the *Baraisa*: יתר עליו תהלים שמונה. Perhaps this 8 is referring not to the excess in פסוקים of *Tebillim* over Torah but to the midpoint of the letters in *Tebillim* appearing 8 verses before expected.

⁶⁰ See footnote 33 for a discussion of the length of *Divrei Hayamim*.

10. The Changes Continue

If our conjecture that the *risbonim* designed a 46-verses page is correct, what happened to cause that S”T style to change in time? We have previously discussed Ezra and the innovations he introduced into the script of the Torah, and how that innovation changed the template of the S”T. In fact, Ezra’s contributions went far beyond the script of the Torah. He was also responsible for many of the current rules of Torah readings:

בבא קמא פב. עשרה תקנות תיקן עזרא שקורין במנחה בשבת וקורין בשני ובחמישי...: שיהו קוראין במנחה בשבת משום יושבי קרנות: ושיהו קוראין בשני ובחמישי עזרא תיקן? והא מעיקרא הוה מיתקנא דתניא (שמות טו) וילכו שלשת ימים במדבר ולא מצאו מים דורשי רשומות. אמרו אין מים אלא תורה שנאמר (ישעיהו נה) הוי כל צמא לכו למים כיון שהלכו שלשת ימים בלא תורה נלאו עמדו נביאים שביניהם ותיקנו להם שיהו קורין בשבת ומפסיקין באחד בשבת וקורין בשני ומפסיקין שלישי ורביעי וקורין בחמישי ומפסיקין ערב שבת כדי שלא ילינו ג' ימים בלא תורה. מעיקרא תקנו חד גברא תלתא פסוקי אי נמי תלתא גברי תלתא פסוקי כנגד כהנים לויים וישראלים אתא הוא תיקן תלתא גברי ועשרה פסוקי כנגד עשרה בטלנין:

The *Gemara* concludes that Ezra introduced a new Torah reading on *Shabbos* afternoon, and changed the general reading requirement from three verses distributed amongst 1, 2 or 3 readers to 3 readers each requiring a minimum of 3 verses individually and 10 cumulatively. It is not clear from the *Gemara* whether the *Shabbos* morning reading originally followed the same format as the weekday morning reading, or if it had always been 7 *olim* (with how many verses?). Rambam writes:

הלכות תפילה יב:א משה רבנו תיקן להן לישראל, שיהיו קורין בתורה ברבים בשבת ובשני ובחמישי בשחרית, כדי שלא ישהו שלושה ימים, בלא שמיעת תורה. ועזרא הסופר תיקן שיהיו קורין כן במנחה בכל שבת, משום יושבי קרנות; וגם, הוא תיקן שיהיו הקורין בשני ובחמישי שלושה בני אדם, ולא יקראו פחות מעשרה פסוקים.

He too is vague on who is responsible for the current *Shabbos* morning reading format of calling 7 *olim*. The following *Gemara* seems to indicate that in fact the Torah reading on *Shabbos* morning prior to Ezra was not 7 people:

מגילה כא. משנה... בשני וחמישי בשבת במנחה קורין שלשה אין פוחתין מהן ואין מוסיפין עליהן ואין מפטירין בנביא הפותח והחותם בתורה מברך לפניו ולאחריה בראשי חדשים ובחולו של מועד קורין ארבעה אין פוחתין מהן ואין מוסיפין עליהן ואין מפטירין בנביא הפותח והחותם בתורה מברך לפניו ולאחריה זה הכלל כל שיש בו מוסף ואינו יום טוב קורין ארבעה ביום טוב חמשה ביום"כ ששה בשבת שבעה אין פוחתין מהן אבל מוסיפין עליהן ומפטירין בנביא... : גמרא כג. הני שלשה חמשה ושבעה כנגד מי פליגי בה רבי יצחק בר נחמני וחד דעמיה ומנו רבי שמעון בן פזי ואמרי לה ר' שמעון בן פזי וחד דעמיה ומנו רבי יצחק בר נחמני ואמרי לה ר' שמואל בר נחמני חד אמר כנגד ברכת כהנים וחד אמר כנגד שלשה שומרי הסף חמשה מרואי פני המלך שבעה רואי פני המלך תני רב יוסף ג' חמשה ושבעה שלשה שומרי הסף חמשה מרואי פני המלך שבעה רואי פני המלך אמר ליה אביי עד האידנא מאי טעמא לא פריש לן מר אמר ליה לא הוה ידענא דצריכתו ליה ומי בעיתו מינאי מילתא ולא אמרי לכו אמר ליה אמר ליה יעקב מינאה לרב יהודה הני ששה דיוה"כ כנגד מי אמר ליה כנגד ששה שעמדו מימינו של עזרא וששה משמאלו שנאמר (נחמיה ח) ויעמוד עזרא הסופר על מגדל עץ אשר עשו לדבר ויעמוד אצלו מתתיה ושמע ועניה ואוריה וחלקיה ומעשיה על ימינו ומשמאלו פדיה ומישאל ומלכיה וחשום וחשבדנה זכריה משלם הני שבעה הוו היינו זכריה היינו משלם ואמאי קראו משלם דמישלם בעובדיה.

The *Gemara* asks for the reason for having more than three *olim* on *Shabbos* and *Yom Tov*, and justifies it with a reference to the way the Persian palace system was set up in the time of Mordechai and Esther.⁶¹ Similarly when the *Gemara* questions about the number

⁶¹ This is how Rashi explains the references to the "seven who see the face of the King." Tosfos disagree and say it refers to the following verse:

מלכים ב:כה:יח וַיִּקַּח רַב טַבָּחִים, אֶת שְׂרָיָה כִּהֵן הָרָאשׁ, וְאֶת צְפַנְיָהוּ, כִּהֵן מְשֻׁנָּה; וְאֶת שְׁלִישׁת, שְׂמָרֵי הַסֵּף. יט וּמִן הָעִיר לָקַח סָרִיס אֶחָד אֲשֶׁר הוּא פֶקִיד עַל אַנְשֵׁי הַמְּלָחָמָה, וְחַמְשָׁה אַנְשִׁים מֵרָאִי פְנֵי הַמֶּלֶךְ אֲשֶׁר נִמְצְאוּ בְּעִיר, וְאֶת הַסֵּפֶר שֶׁר הִצְבֵּא, הַמְּצָבָא אֶת עִם הָאֲרָץ; וְשֵׁשִׁים אִישׁ מֵעַם הָאֲרָץ, הַנִּמְצָאִים בְּעִיר.

of readings on Yom Kippur, the response is with an analogy from Ezra. We find it unlikely, if Moshe had instituted a 7-person reading system on *Shabbos*, that the *Gemara* would justify it with repeated references to verses occurring in the generation immediately preceding Ezra. Rather, it seems that all Torah readings prior to Ezra involved a minimum number of people (from 1 to 3) and a minimal number of verses (3), and it was only Ezra who introduced the concept of more extensive readings.

If Ezra was responsible for the more extensive readings on *Shabbos*, it is he who at least set in motion what eventually became the reading of the entire Torah within a one-year period. The first *Asburi* S”T that we described, with 46 verses per page, 134 pages and a single *etz chaim* on the *Bereshis* side that was rolled up to the *Devarim* end after being used, was either very high, very wide or a bulky combination of the two. If the next use of the *Sefer Torah* was toward the start of *Bereshis*, it required scrolling through up to 134 pages.⁶² We are uncertain as to how the S”T was turned to the desired place. If the *Devarim* side was rolled into a cylindrical shape, why wasn’t an *etz chaim* placed there as well for ease of maneuverability?⁶³ It may be

Note שריה mentioned here is Ezra’s father. Thus even according to Tosfos the *Gemara*’s proof is from approximately the same era.

⁶² Although Ezra introduced most of what we read today in the Torah on *Shabbos* and *Yom Tov*, Moshe did designate readings for the שלש רגלים, שלש רגלים and יו”כ, to wit

הלכות תפילה פרק יג:ח...משה תיקן להן לישראל, שיהיו קוראין בכל מועד, עניינו; ושואלין ודורשין בעניינו של יום, בכל מועד ומועד. ומה הן קורין: בפסח, בפרשת המועדות שבתורת כהנים ט בעצרת, קורין ב"שבעה שבועות" (דברים טז, ט) ... י בראש השנה, קורין "בחודש השביעי באחד לחודש" (ויקרא כג, כדף במדבר כט, א)... יא ביום הכיפורים, בשחרית, קורין "אחרי מות" (ויקרא טז, א), ומפטירין "כי כה אמר רם ונישא" (ישעיהו נז, ט). במנחה, קורין בעריות שב"אחרי מות", כדי שיזכור וייכלם כל מי שנכשל באחת מהן, ויחזור בתשובה; יב בסוכות, בשני ימים הראשונים, קורין בפרשת מועדות, וביום טוב אחרון, קורין "כל הבכור" (דברים טז, ט).

Note that every one of these readings is in the 2nd half of the Torah. Is it perhaps because of this that according to Rashi the roller was on the beginning of the Torah, since for the required readings a roller on that side minimized the amount of required scrolling?

⁶³ Ezra’s newly designed S”T would not be conducive for private learning sessions. We assume *Chumashim* (i.e. individual books) were used for this purpose.

that the back pages were not rolled but folded over as is done with a *megillab*. If so, then when the actual reading page was finally located, the bulk and height would have made it difficult to move to a different page. As long as the required reading, even on *Shabbos* morning, was limited to only several verses, this design would present no problem. But with the introduction of the new expanded readings, this would no longer be operationally practical. Particularly with the introduction of the yearly Torah reading cycle, there were times when 3 or even more pages were to be read at one session.⁶⁴ How were they to be easily read? We suggest that this innovation by Ezra ultimately generated the need to have an *etz chaim* to roll the text in both directions, and smaller more maneuverable pages that would make the Torah more flexible. This switch resulted in the S”T almost doubling in the number of pages, but making it smaller and allowing it to be left rolled up to somewhere in the middle of the Torah. In this case, even if it was necessary to roll the scroll to either its beginning or end, the amount of rolling would be less than it was under a one-roller system where the *Sefer Torah* was always left at its beginning or end.

11. Middle Letter and Word

Table 6 gives the *Gemara’s* as well as the actual middle word, letter and verse, and their discrepancies.

Table 6

Middle Letter, Word and Verse

Gemara’s vs. Actual

<u>Property</u>	<u>According to Gemara</u>	<u>חומש In our</u>	<u>Difference</u>
Middle Word	ויקרא י:טז	ויקרא ח:טז	933 words
Middle Letter	ויקרא יא:מב	ויקרא ח:כט	4,822 letters
Middle Verse	ויקרא יג:לג	ויקרא ח:ח	160 verses

הלכות ס”ת ז:זיד מותר לכתוב התורה חומש חומש, כל חומש בפני עצמו, ואין בהן קדושת ס”ת התם.

⁶⁴ E.g. מטות and מסעי when read together have 244 verses, which would be more than five 46-verse pages.

We have thus far attributed the 160-verse discrepancy to:

- The *Gemara's* using the last page as if it were full of verses.
- The *Gemara's* looking for the middle verse of this virtual Torah.
- The *Gemara's* verse is on the top of a page.
- The *Gemara's* verse is exactly 3 pages (138 verses) after it should be.
- The *Gemara* includes the 6 blank pages placed at the end of the S”T.

We now turn our attention to the middle-letter and middle-word discrepancy. As previously discussed, the number of letters and number of words in the Torah are respectively about 304,805 and 79,980. While we have until now discussed the idea of dividing the Torah into pages with an equal number of verses, we could also construct a S”T that had an equal number of letters or words per page. Being that verses have a variable number of words, and words have a variable numbers of letters, it is reasonable to assume that the pages’ “layout” for a S”T constructed to have an equal number of words per page will be more similar than one with an equal number of verses per page; and that a S”T with pages that have an equal number of letters will have the most visually similar pages of all.⁶⁵ It is therefore reasonable to assume that if the *soferim* experimented with an equal number of verses per page, they also considered the word and letter options. It is our feeling that the *soferim's* choice of middle letter and middle word supplies the evidence of how they produced each of these alternatives.

Dividing the S”T into Pages with an Equal Number of Letters

To create the 46-verses-per-page S”T, the *soferim* added 43 “virtual” verses and worked with the number 5,888. When creating a S”T with an equal number of letters per page, no such major correction is needed. A simple spreadsheet analysis (Table 7) shows that for such a

⁶⁵ Note that the fact that all pages have the same number of letters does not mean their “layouts” are carbon copies of each other. As we have previously discussed, different letters take up different amounts of horizontal space, and additional spaces due to *Pesuchas, Setumos, Chumash* separators, etc. must be considered.

S”T to have an integer number of pages between 120 and 140 in length (i.e. it should be relatively similar to the one made by having 46 verses per page), it must be constructed on the basis of having 304,800 or 304,799 letters.

Table 7

Scenarios for an Equal-Number-of-Letters-Per-Page S”T

<u>Case</u>	<u>Total # of Letters</u>	<u>Total # of Pages</u>	<u>Letters Per Page</u> ⁶⁶	<u>ן of ןהן Page Location</u>	<u>Actual Middle Letter Page Location</u> ⁶⁷
1	304,800	120	2540	61.90	60.00
2	304,800	127	2400	65.51	63.50
3	304,799	121	2519	62.42	60.50

Because letters are parts of words, this design is slightly different from the equal-number-of-verses design in that not every page will have the number of letters listed in the 4th column. For example, suppose in Case 1, which is designed to have 2,540 letters, the 2,539th letter on a page is the last letter of a word and the 2,540th letter is the first letter of a 5-letter word. In this case, the 5-letter word can be continued on the same page, which will have 2,544 letters; or start the next page, and the current page will have 2,539 letters. Thus positioning rules⁶⁸ are necessary on the *sofer's* part. However, the design will easily accommodate several extra/fewer letters per page without being visually different. Similarly, even though a S”T has more letters than indicated in the second column, the few extra letters are easily accommodated.

In comparing the 3 scenarios of Table 7, the only one that has the ן of ןהן in a distinctive position on a page is Case 2, which is .01 from the exact middle of the page. Although .01 of a page is

⁶⁶ I.e. the second column divided by the third column gives the fourth column.

⁶⁷ If the total number of pages is N, the number in this column is N/2. If N is even (e.g. 120), N/2 (60.00) means after the end of N pages (i.e. bottom of page 60 or top of page 61). If N is odd (e.g. 127) then N/2 (63.5) refers to the middle of the page (middle of page 64).

⁶⁸ E.g. no less than 2,535 letters to a page and no more than 2,545. These rules would be very similar to those given in *Hilchos Sefer Torah* 7:6-7.

about 24 letters from the exact page center, considering our lack of expertise in *yud's* and *vav's*, and, as explained, not every page has exactly 2400 letters, it is close enough that when laying out the S" T the *vav* of *gachon* may very well be the center letter on the page. Because of the positioning of the *vav* of *gachon* on the page, and the fact that the total number of pages is only one less than it is for the S" T designed to have 46 verses per page, we feel strongly that Case 2 is the one the *soferim* targeted,⁶⁹ since in that case the actual middle and the one the *Gemara* gives are both directly in the middle of a page, albeit 2 pages apart.

Dividing the S" T into Pages with an Equal Number of Words

The results of a similar spreadsheet analysis done this time to investigate the viability of designing a S" T with an equal number of words per page are given in Table 8.

Table 8

Scenarios for an Equal-Number-of-Words-Per-Page S" T

<u>Case</u>	<u>Total # Of Words</u>	<u>Total # of Pages</u>	<u>Words Per Page</u>	<u>דרש דרש Page Location</u>	<u>Actual Middle Word Page Location</u>
1	79,981	121	661	61.91	60.50
2	79,980	124	645	63.45	67.00
3	79,980	129	620	66.00	64.50

In comparing the 3 scenarios of Table 8, the only one that has *דרש דרש* in a distinctive position on a page is Case 3, where they

⁶⁹ It is additionally appropriate that in the case of the middle letter the S" T have an odd number of pages. In this way the *vav* of *gachon* can possibly be in the exact middle of the page. If, however, the total number of pages were even, there is no way that a *vav* in the middle of a word can be the first letter on a page.

are the 3rd and 4th words on the top of the page (the numbers in the chart are to the nearest 2 decimal places). Although we ideally would have preferred that one *דרש* end a page and the other start a page (סופרים ט:ב...דרש דרש חצי תיבות של תורה דרש בסוף שיטה דרש בראש (שיטה), considering that there is some doubt as to a few words, and that the count in the back of all *Chumashim* says there are 79,976 (not 79,980) words, it is possible that the *soferim* counted *דרש דרש* three words earlier. Because of the positioning of *דרש דרש* on the page and the fact that the total number of pages is only one more than it is for the initial division by 46 words, we feel strongly that Case 3 is the one the *soferim* were targeting, i.e. the actual middle and the one the *Gemara* gives are either directly in the middle of a page or at the top of a page, albeit 1½ pages apart.

Table 9 summarizes all of our results for the different ways of writing a S”T, i.e. equal verses, letters or words, and the last column gives how many blank pages would be necessary to add at the end of each S”T in order to make the *Gemara*’s letter/word/verse the actual middle one. Note for the letter scenario, the *vav* of *gachon* is exactly in the middle of the middle page, while for the word scenario the middle *דרש דרש* is appropriately separated over two pages.⁷⁰

Table 9

Summary of Equal Letter/Word/Verse *Sefer Torah*

<u>Property</u>	<u>Total Number⁷¹ Of Pages</u>	<u>Gemara’s Middle On Page</u>	<u>Blank Pages at End of Sefer Torah</u>
Middle Letter	131	65.5	4
Middle Word	132	66.0	3
Middle Verse	134	67.0	6

⁷⁰ Assuming the slight change in letters and words previously discussed. These slight changes would represent the only differences between their S”T and ours.

⁷¹ The second column is formed by doubling the third column, and the last column is formed by subtracting the number of pages previously stated as being required from the number in column 1. For example, 131 for the middle letter is 2*65.5, and the 4 in the last column is 131 less the 127 of Table 7 Case 2.

Table 9 demonstrates that all of the *Gemara's* highlighted letter/words/verse can be shown to be at the center of a symmetrically constructed S”T that includes an appropriate blank parchment wraparound at the end,⁷² without resorting to contrived categories of letters and words. It furthermore demonstrates the practicality of the *soferim*, and that their interest in counting was to create the most attractive *Sefer Torah* that they could. Toward this end they have given us the design of three S”T where each is based on a different reasonable objective of equalizing the content of all of the pages. The first two designs are implicitly given by stating the middle letter and middle words, and the last design, equalizing the number of verses, is more explicitly conveyed in the repeated allusions to numbers that are multiples of 46. As discussed previously, the frequency of the numbers in the *Gemara* divisible by 46 is so high as to eliminate any possibility of occurrence by chance, and is clearly indicative of a plan to have 46 verses on each page.

In reviewing the results of our analysis of letters and words, it would further appear that these two designs were the motivation for

⁷² It **does not** mean that all of these are simultaneously middle letter, word and verse. Note in Table 9 that the number of blank pages in each design is different. As mentioned in Section 9, we expect the variability between pages is greatest in the equal-number-of verses-per-page design since the word-size of verses can vary greatly. However, we surmised that since we are using a rather large number of verses per page, i.e. 46, the average numbers of words per page would always be about the same. This turns out not to be the case. The Chart below lists details of the relationship between letters, words and verses in each *Chumash*.

	Number of <u>Words</u>	Number of <u>פסוקים</u>	Average Words Per <u>Verse</u>	Average Letters Per <u>Word</u>	Average # of Words in 46 <u>Verses</u>
<u>חומש</u>					
בראשית	20,614	1,533	13.4	3.8	619
שמות	16,714	1,210	13.8	3.8	635
ויקרא	11,950	859	13.9	3.8	640
במדבר	16,408	1,288	12.7	3.9	586
דברים	<u>14,294</u>	<u>956</u>	<u>15.0</u>	<u>3.8</u>	<u>688</u>
Total	79,980	5,846	13.7	3.8	629

the 46-verses design. While we have identified the evidence pointing to a 46-verses design, we have not addressed why the Chachamim specifically choose the number 46. In order to make the 46 design work, the Chachamim were forced to create a 5,888 verse “virtual” Torah whose final 128th page could accommodate 45 verses more than is necessary. The following chart offers 4 other possible ways to break up the Torah into an equal number of verses without having to add more than 11 verses to the actual count of 5,845 verses. In each of these cases, the total number of pages is not dramatically different from the 128-page S”T we have described, but the final page is almost full with “actual” verses. Why then did the *soferim* choose to use 46 verses per page?

<u>Case</u>	<u>Total # of Verses</u>	<u># of Pages</u>	<u>Verses per Page</u>
1	5,856	122	48
2	5,852	133	44
3	5,850	130	45
4	5,848	136	43

We suggest that 46 was chosen precisely because it has the property first mentioned in Section (9), that the middle number of words, letters and verses is at the top of three successive pages.⁷³ By maneuvering the verse that contained the middle letter in a S”T divided by letters, and the verse that contained the middle word in a S”T divided by words to fall in the first verse in consecutive pages of a S”T, the knowledge of the positions of the middle letter and middle word was preserved in the event that anyone would want to design a

While the number of letters per word is almost the same for all *Chumashim*, the number of words per 46-verses page varies greatly by *Chumash*, with *Devarim* having 17.4% more words per page than *Bamidbar*. Thus the 129 written pages for a *Sefer Torah* designed to have 620 words per page will be more similar than the 128 written pages for a S”T designed to have 46 verses per page. Whether it is the height, width or a combination of both that will be manipulated to accommodate the disparity in words, the fact is that the pages will be different. This in turn will affect the circumference of the S”T and the number of blank pages needed to enwrap it.

⁷³ The *naf* of *gachon* and *דרש דרש* are within 5 words from the start of the page.

Sefer Torah based on either letters or words. We note *Maseches Soferim* 9:2 suggests that the *vav* of *gachon* be large because it is the middle letter and to put *דרש דרש* on separate lines because they are the central words. *Maseches Soferim* thus felt it necessary to do something to highlight these letters and words even though they are the middle letter or words only in a specially designed S”T. Note that neither the need to enlarge the *vav* nor to separate *דרש דרש* is mentioned in *Maseches Sefer Torah*. We suggest it is precisely because *Maseches Sefer Torah* was written much earlier and used the 46-verse-per-page S”T. As such, both the *vav* of *gachon* and *דרש דרש* appeared on the top of a page and did not require any further highlighting.

12. Conclusion

The scenarios we have outlined in this paper concerning the physical evolution in the S”T, we feel, are well motivated and address many issues and *Gemaras* that have never been fully explained or linked. In the process we have also demonstrated that the symmetry we are stressing exists only if our current Torah is almost exactly the one the original *soferim* had. Thus, rather than this *Gemara* challenging our current Masorah, it in fact validates it. We have also addressed almost all of the questions we originally asked, with the exception of the *Zohar’s* claim of 600,000 letters. Suffice it to say without detail that this too can be explained in terms of the design of a S”T that has an equal number of spaces (i.e. letters and blanks) per page. The details are no different from what we have already done for verses, letters and words.

We note in closing that the words of the *Gemara* in *Kiddushin* 30a quoting from the results of the *Soferim* read almost like the middle page of a three-page how-to booklet where the 1st and 3rd pages were lost and everyone is trying to determine the objective of the entire 3-page booklet. In this vein, even if our conjectures as to what the *Soferim* really wanted to accomplish are incorrect, we feel we have identified some fascinating mathematical symmetries in their calculations that cannot be ignored and opened up a new, more mature way of looking at the *Gemara* that will ultimately succeed in divining the *soferim’s* true objectives. ❧

Appendix A

Letters in the Torah

	Number in	Yud	Yud	Letter	Total
	<u>Torah</u>	Strokes	Spaces	Spelling	Spelling
		<u>RK</u>	<u>RK</u>	<u>RA</u>	<u>RA</u>
א	27,057	2	54,114	3	81,171
ב	16,344	2	32,688	3	49,032
ג	2,109	1	2,109	4	8,436
ד	7,032	2	14,064	4	28,128
ה	28,052	2	56,104	2	56,104
ו	30,509	1	30,509	2	61,018
ז	2,198	1	2,198	3	6,594
ח	7,187	2	14,374	3	21,561
ט	1,802	3	5,406	2	3,604
י	31,522	1	31,522	3	94,566
כ	11,960	2	23,920	2	23,920
ל	21,570	2	43,140	3	64,710
מ	25,078	3	75,234	2	50,156
נ	14,107	1	14,107	3	42,321
ס	1,833	2	3,666	3	5,499
ע	11,244	2	22,488	3	33,732
פ	4,805	3	14,415	2	9,610
צ	4,052	2	8,104	3	12,156
ק	4,694	2	9,388	3	14,082
ר	18,109	2	36,218	3	54,327
ש	15,592	3	46,776	3	46,776
ת	<u>17,949</u>	2	<u>35,898</u>	2	<u>35,898</u>
	304,805		576,442		803,401

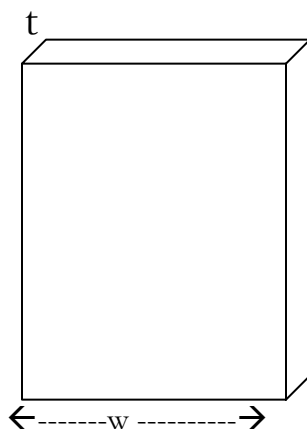
Appendix B

A Mathematical Analysis of the 9th Chapter of *Hilchos Sefer Torah* Thickness of Rambam's Parchment

Rashash, Baba Basra 14b, discusses the difference in the circumference of a one- and two-*atzrei-chaim* S"Y. This Appendix expands *Rashash's* analysis to calculate the thickness of Rambam's parchment. This is the one critical piece of information Rambam left out from his presentation in the 9th chapter of *Hilchos Sefer Torah* on how he wrote a S"Y that had equal circumference and height. The analysis is divided into several different cases, with each case building on the results of the previous one.

Case 1—No Roller

Assume n identical pieces of parchment, פקל, of height h , width w , and thickness t (see diagram below) that are stitched together along the length of the pages and, without the use of an *etz chaim*, are tightly rolled from one end to the other with negligible space between successive layers of parchment. The surface area at the top of the roll is formed by the thickness and the width of the sheets (not length).



If r is the radius of the cylinder formed by the rolled parchments, the surface area of the top of the rolled parchment is:

$$\text{Surface Area} = \pi r^2 = nwt$$

Solving for the radius of the circular top of the roll we get:

$$(1) \quad r = \sqrt{nwt/\pi}$$

and the Circumference of the roll and cylinder are given by

$$(2) \quad \text{Circumference} = 2\sqrt{nwt\pi}.$$

Case 2—One Roller⁷⁴

If one end of the parchment is wrapped around a central cylindrical Etz Chaim that has a radius r_{etz} , then the surface area on top of the Etz is πr_{etz}^2 , and this area must be added to the area of the parchment to arrive at the total surface area of the S”T, i.e.:

$$\text{Surface Area} = \pi r^2 = nwt + \pi r_{etz}^2,$$

and (1) and (2) become:

⁷⁴ We assume in this analysis that when the *Gemara* and Rambam prefer that the Circumference of the S”T equal its height, it includes the contribution of the Atzei Chaim to the circumference. Rambam’s own language would seem to disagree, i.e.

ט: כיצד יתכוון אדם, עד שייעשה הספר שיהיה אורכו כהיקפו: מתחיל ומרבע העורות בשווה, ועושה רוחב כל עור מהן שישה טפחים, קצב אחד לכול. ואחר כך גולל העורות, ועושה מהן כרך אחד, מהודק יפה יפה; ומוסיף בעורות ומהדק, עד שייעשה היקף הכרך שישה טפחים, שהוא רוחב העור. ומודד בחוט של שני, שמקיפו על הכרך.

with no mention of an *etz chaim*. However, Rambam here is offering a suggestion that is to be used only for approximation purposes. As we will show later, Rambam’s *atzei chaim* were considerably under an *etzba* in radius and contributed little to the actual surface area of the S”T. Thus, preliminary calculations could be done that completely ignored the *atzei chaim*. In the final analysis, however, it is the outside appearance of symmetry when the cover is on the S”T that gives the *Sefer* an esthetically pleasing look. If the circumference of the rollers was not meant to be included in this final measure, then what exactly is the significance of the symmetry that makes it so desirable?

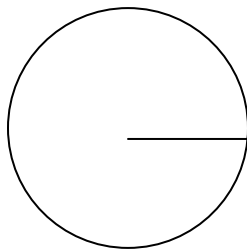
$$(1') \quad r = \sqrt{(nwt/\pi) + r_{etz}^2}$$

$$(2') \quad \text{Circumference} = 2\pi(\sqrt{(nwt/\pi) + r_{etz}^2})$$

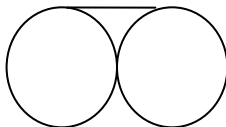
Case 3—Two Rollers

Case 2 represents the early S”T when only a single roller was used (figure (a) below). Rambam’s S”T was rolled toward the center around two *atzei chaim* (figure (b)). Since the 2 smaller circles are identical⁷⁵ we can use equations 1’ and 2’ to calculate the radius, r_s , of each of the circles. In this situation the number of pages is $n/2$, i.e. one half of the actual number of columns in the S”T, since half of the *Sefer* is on the left *etz*⁷⁶ and the other half is on the right *etz*.

(a)



(b)



⁷⁵ At any point in time the S”T can have more pages on one side than on the other. However, our objective is to measure the circumference of the S”T at its maximum when covered. This is achieved when the S”T is rolled to its center.

⁷⁶ This very slightly overstates the situation, since the parchment that bridges the space between the 2 circles contains a small amount of surface area that is not being included in our calculations.

Once r_s has been determined, the Circumference⁷⁷ of figure b can be determined. To completely enwrap b, it is necessary to encompass the left side of the left circle, the right side of the right circle, the line segment that joins the 2 circles on top and a similar distance that spans the distance between the 2 circles on bottom. Thus

$$(3) \quad \text{Circumference of (b)} = .5*2\pi r_s + .5*2\pi r_s + 4r_s \\ = (2\pi + 4) r_s$$

Since the Circumference of Rambam's Torah is 24 *etzbaos*,

$$(4) \quad r_s = 24/(2\pi + 4)$$

Putting (4) together with (1') yields:

$$\sqrt{(.5nw/\pi) + r_{etz}^2} = 12/(\pi + 2)$$

and solving for t gives:

$$(5) \quad t = \pi ((12/(\pi + 2))^2 - r_{etz}^2) / .5nw$$

For Rambam's S"Y: $n=226$, $w=6$ *etzbaos*, and $r_{etz} = .48$ *etzbaos*,⁷⁸

⁷⁷ Circumference here means how long a string would have to be to completely encircle the S"Y, as Rambam describes at the end of halacha 3.

⁷⁸ The size of Rambam's r_{etz} is determined as follows:
 ט:י ספר תורה שכתבתי אני--רוחב כל דף ודף מדפיו, ארבע אצבעות; ושירת הים ושירת האזינו, רוחב כל דף משתיהן שש אצבעות; ומניין השיטין שבכל דף ודף, אחת וחמישים; ומניין הדפין של כל הספר, מאתיים שישה ועשרים דף; ואורך כל הספר, אלף ושלוש מאות ושישים ושש אצבעות, בקירוב.

Of Rambam's 1,366 *etzbaos* length, 1,360 come from the 224 pages that were 6 *etzbaos* wide plus the 2 pages that were 8 *etzbaos* wide. The remaining 6 *etzbaos*:

יא אלו השש אצבעות היתרות בחשבון, לגיליון שבתחילת הספר ושבסופו.
 i.e. 3 *etzbaos* of parchment wraps around the *etz chaim* on the right and another 3 *etzbaos* wraps around the *etz chaim* on the left (see also last phrase in:

and the thickness of Rambam's S"Y was thus .024 *etzbaos*.⁷⁹ Since there are 4 *etzbaos* in a טפח, and a *tefach* is between 3.3 inches (R' Chayim Na'eh) and 4.2 inches (Chazon Ish), then an *etzba* is between .825 and 1.05 inches. Thus in terms of inches Rambam's parchment was between .02 and .025 inches thick.

H"Y Chapter 9, footnote 4 writes:

הנה אני עשיתי בספר תורה שכתבתי בכל המידות האלה ולא איתרמי לי וראיתי כי של גויל היה שהוא עב אבל בקלף שלנו א"א לכוין...

i.e. he was unable to duplicate Rambam's results because his S"Y parchment was thinner. This explains why it is so difficult now to reproduce Rambam's results. For example, the thickness of parchment used in today's S"Y is about .012 inches or less. Using this thickness in equation 3, and holding all other values the same as those that Rambam used, yields a Circumference of approximately 18.9 *etzbaos*, i.e. 5.1 *etzbaos* (21.2%) smaller than Rambam's.⁸⁰ Thus

ט:ב שיעור הגליון מלמטה, ארבע אצבעות; ולמעלה, שלוש אצבעות; ובין דף לדף, שתי אצבעות. לפיכך צריך שיניח בתחילת כל יריעה ובסופה, רוחב אצבע אחת וכדי תפירה-- שנמצא כשתיתפר היריעה, יהיה בין כל דף ודף בכל הספר כולו, שתי אצבעות. ויניח מן העור בתחילת הספר ובסופו, כדי לגול עמוד.

(Note: H"Y says that the 2nd word in *halacha* 11 should be 4, not 6 *etzbaos*. This would change the radius of the *etz* but not alter the remaining numbers very much). If the circumference of an *etz* is 3 *etzbaos* then its radius must be $3/2\pi$.

⁷⁹ This is an upper bound on the thickness of Rambam's parchment, since there are other sources of surface area that we have not included. As stated in *halacha* 2 (previous footnote), each parchment section has an extra *etzba* at each end to allow the parchment sections to be sewn together. There are between 3 and 8 columns of writing in each parchment section (*halacha* 12), and Rambam's S"Y had 226 columns. Thus, his S"Y had at least 27 parchment sections and at least an additional 54 *etzbaos* of thickness. Finally, the end *etzba* of each parchment section sewn together protrudes slightly and does not allow an airtight rolling of the parchment. This too would increase the overall circumference of the S"Y.

⁸⁰ Expanding the size of the *atzei chaim* could also materially affect the circumference. We note that *Aruch Hashulchan* in *Hilchos Sefer Torah* does not mention the size of the *atzei chaim*.

anyone trying to replicate Rambam's S"t without having similar parchment thickness will not succeed in equalizing circumference and height. Alternatively, using the formulae we have developed one can map out on paper a circumference-height equality by judiciously choosing the relevant variables.