Calendar tables in manuscript and printed *Arbaʿah Ṭurim*: *Ṭur Oraḥ Ḥayyim*, chapter 428

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ABSTRACT This article is a case study in the creation, transmission and evolution of calendar tables in medieval and early modern Jewish sources. It looks at calendar tables in *Arbaʿah Ṭurim* by Jacob ben Asher (early fourteenth century), one of the most influential rabbinic codes of law. Calendar tables in printed editions of *Arbaʿah Ṭurim* (*Ṭur Oraḥ Ḥayyim*, chapter 428) deviate from the normative rabbinic calendar and can lead to celebrating religious holidays at the wrong times. The inclusion of non-standard tables in an authoritative code of law has long raised questions about their authenticity. This article examines the history of calendar tables in *Ṭur Oraḥ Ḥayyim* by investigating all extant manuscripts and fifteenth- to sixteenth-century printed editions of the code. The article highlights the unstable connection of calendar tables with authorial compositions and the lack of calendar expertise among copyists and users of calendar tables.

THE CODE *Arbaʿah Ṭurim* ('The Four Rows') is the main work of an eminent legal scholar Jacob ben Asher (Cologne *c*.1270–Toledo after 1340).[1] Composed in Toledo by a Halakhist of Ashkenazi origins, by the fifteenth century *Arbaʿah Ṭurim* became a widely used and authoritative work, both in Sefarad and in Ashkenaz.[2] Its first part, *Ṭur Oraḥ Ḥayyim* ('The Way

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1. On Jacob ben Asher and his work *Arbaʿah* Ṭurim, see Y.D. Galinsky, 'The Four *Turim* and the Halakhic Literature of 14th Century Spain: Historical, Literary and Halakhic aspects' (in Hebrew; Ph.D. thesis, Bar Ilan University, 1999); A. Freimann, 'Die Ascheriden (1267–1391)', *Jahrbuch der Jüdisch-Literarischen Gesellschaft* 13 (1920), pp. 142–254, esp. pp. 160–211; E. Kupfer and D. Derovan, 'Jacob ben Asher', in *Encyclopaedia Judaica*, vol. 11, pp. 30–31, and the references cited there. Consulted on Gale Virtual Reference Library; accessed 29 January 2018.

2. Galinsky, 'The Four *Turim*', pp. 290–307. Y.D. Galinsky, '"And this scholar achieved more than everyone for all studied from his works": On the Circulation of Jacob b. Asher's *Four Turim* from

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of Life', henceforth TOH), is dedicated to laws of prayer, blessings, Sabbath and festivals. In its section on the laws of the New Moon, Jacob ben Asher includes a short account of the fundamentals of Jewish calendar reckoning.[3] This account is supplemented by two tables: (1) a pre-calculated calendar said to cover 5055–6000 AM (1294/5–2239/40) and (2) a table laying out the possible courses of the Jewish liturgical year. Together the two tables give a reader all required information on the months, festivals, fasts and Bible pericopes in any year of interest.

In all printed editions of TOH the pre-calculated calendar is presented as a cycle of 247 years that repeats itself four times (FIGURE 1). Such cycles, often styled *ʿIggul de-Rav Naḥshon*, are based on the claim that the Jewish calendar repeats itself exactly after 247 years, so that once a correct calendar for 247 years is established, it can be used indefinitely without any changes.[4] The claim that 247 years represent a cycle holds only approximately in the framework of the standard Jewish calendar: if a calendar for 247 years compatible with the standard rules is reused for the following 247 years, it will deviate from a calendar calculated for these next 247 years in 2 to 17 years.[5] Further reiterating the 247-year calendar multiplies the mistakes. Following the calendar printed in TOH can lead to celebrating religious holidays at the wrong times from the perspective of the standard rabbinic calendar, most importantly eating leavened bread at Passover and not fasting on the Day of Atonement.

The inclusion of a non-standard calendar in a major code of rabbinic law did not remain unnoticed. The reiterative calendar was criticized in sixteenth- to seventeenth-century commentaries on TOH, such as *Levush*

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the Time of Its Composition until the End of the Fifteenth Century', *Sidra* 19 (2004), pp. 25–45 (in Hebrew).

3. Chapters 427–8 in printed editions. The numeration of chapters in manuscripts is unstable and not always present (see Galinsky, 'The Four *Turim*', p. 321 and nn. 51–2 there; N. Vidro, 'Manuscript to Print and Print to Print: On the Transmission History of Jacob ben Asher's *Ṭur Oraḥ Ḥayyim*', *Zutot: Perspectives on Jewish Culture*, forthcoming.

4. On the 247-year cycle, see S. Stern, *Calendar and Community: A History of the Jewish Calendar, 2nd cent. BCE–10th cent. CE* (Oxford: Oxford University Press, 2001), p. 193; Y. Tobi, *The Jews of Yemen: Studies in Their History and Culture* (Leiden: Brill, 1999), pp. 211–26; N. Vidro, 'The Origins of the 247-year Calendar Cycle', *Aleph* 17:1 (2017), pp. 95–137, and the references cited there.

5. This is because the *molad* (mean conjunction) recurs almost exactly after 247 years but is 905 parts smaller. The 905 parts are inconsequent for the fixation of most years but make a difference in years with a *molad* close to its allowable limit. On the accuracy of the 247-year cycle, see E. Raviv, 'Mathematical Studies in the Hebrew Calendar' (Ph.D. thesis, Bar Ilan University, 2015), pp. 57–62.

Malkhut by Mordecai Yoffe (1530–1612) and *Peri Ḥadash* by Hezekiah da Silva (*c.*1656–1695).[6] Twentieth-century rabbinic scholars dealing with the issue argued that the 247-year cycle found in printed editions is not the original calendar published by Jacob ben Asher but an innovation introduced by ignorant printers.[7] Jacob ben Asher's original calendar, they asserted, conformed fully to the normative rabbinic rules.

The purpose of this article is to carry out a comprehensive survey and analysis of all manuscripts and fifteenth- to sixteenth-century printed editions of TOH that contain the pre-calculated calendar. Unlike earlier scholars who were mainly interested in proving Jacob ben Asher innocent of a gross calendrical (and hence also Halakhic) mistake, I would like to use this material as a case study in the transmission and evolution of calendar tables in medieval and early modern Jewish sources. This perspective necessitates asking a number of research questions:

- Is the transmission of the calendar in manuscripts uniform? If different tables are attested, which is the original one?
- How was the calendar in TOH originally constructed?
- Who chose to insert a reiterative table in TOH?
- What was the attitude of scribes towards the calendar: was the calendar faithfully copied from an exemplar or was it checked and if necessary corrected? How proficient were scribes in Jewish calendar reckoning?
- Were calendar tables in TOH manuscripts ever used?
- If the calendar cycle in TOH is a printers' innovation, when and why was it introduced? Did something in the manuscript transmission require a remaking of the calendar?
- What is the relationship between calendar tables in manuscripts and those in print?

6. See also Y.M. Kagan, *Mishna Berura, chapter 428* (in Hebrew; Warsaw: B. Tursh, 1899), p. 575.

7. Y.A. Silber, *Berur Halakha, Oraḥ Ḥayyim, Part 2* (in Hebrew; Bnei-Braq: Y.A. Silber, 1993), p. 201; Z.H. Yaffe, *Qorot Ḥeshbon ha-ʿIbbur* (in Hebrew; Jerusalem: Darom, 1930), pp. 163–5. Zvi Hirsch Yaffe and Rafael Gordon were the first modern scholars to realize that Jacob ben Asher's original calendar was not cyclical; see below, n. 16 and p. 82.

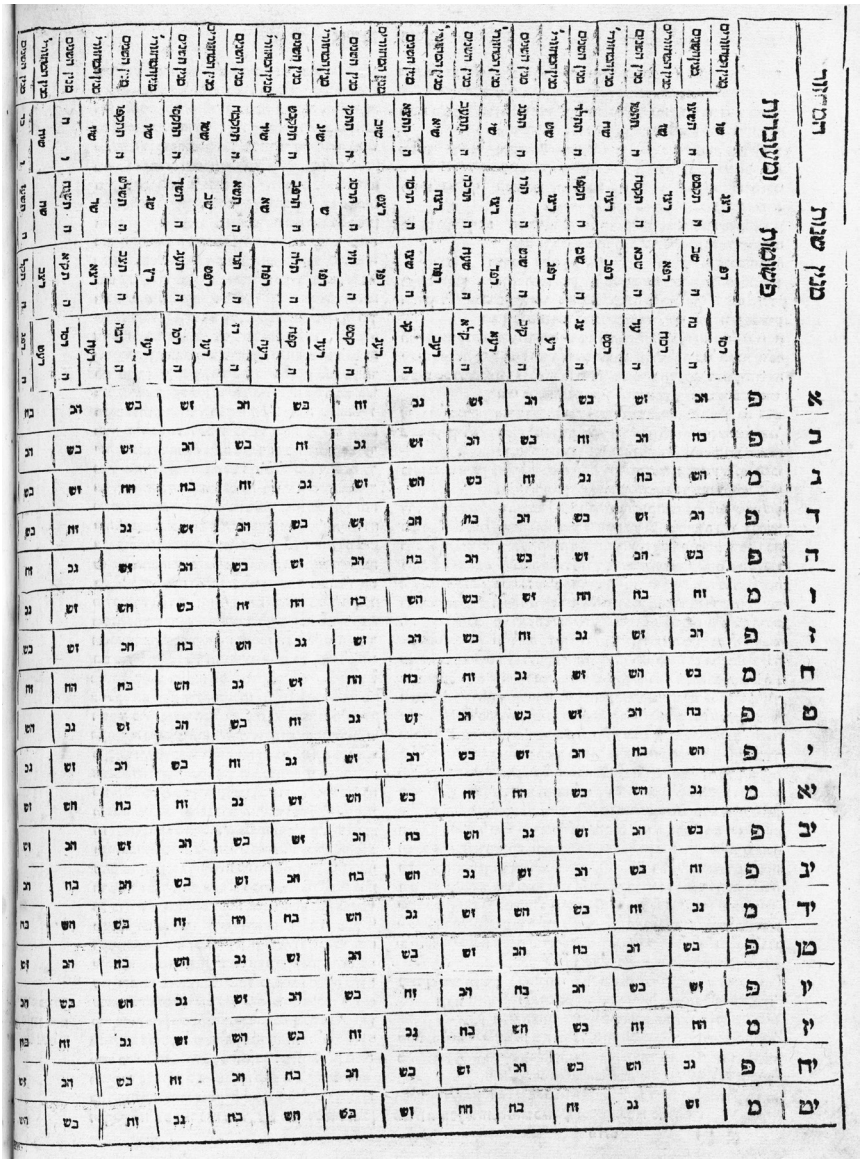

FIGURE 1 Reiterative calendar table in the Constantinople 1540 edition of TOH. *Reproduced by kind permission of the Syndics of Cambridge University Library.*

Pre-calculated calendar tables in the Jewish tradition

Jacob ben Asher's calendar tables belong to a type of calendrical composition frequently attested in Jewish sources. By the later Middle Ages the rules for setting the Jewish calendar were fixed and open to all. However, many Jews lacked the numerical proficiency and calendar reckoning expertise necessary to perform the required operations. For users uninterested in making their own calendar, pre-calculated calendar tables for a range of years were included in books of various genres.

In pre-calculated calendar tables each year is represented by one cell. The cells are arranged in columns (or rows) of 19, which correspond to 19-year cycles of intercalation and are numbered from Creation: cycle 1 stands for years 1–19 AM, cycle 2 for years 20–38 AM, and so on. Each cell specifies the type of year it stands for. The type of year depends on three variables: the day of the week of Rosh Hashanah, the length of the variable months Marḥeshvan and Kislev, and the number of months in that year.[8] In the Jewish calendar, Rosh Hashanah may fall on a Monday, Tuesday, Thursday or Saturday. The pair of months Marḥeshvan and Kislev can be 'defective' (both have 29 days), 'regular' (Marḥeshvan has 29 days and Kislev 30 days) or 'full' (both have 30 days).[9] A Jewish year can have 12 months and be 'plain' or can have 13 months and be 'intercalated'. The inclusion or not of this additional 30-day intercalary month is a function of the 19-year cycle in which 12 years have 12 months and 7 years have 13 months. The permutations of these three variables fully determine the course of a Jewish year. Due to various ritual constraints, only 14 such combinations are permitted, and to set a calendar for a particular year ultimately means to establish which of the 14 types will apply to it.

The type of year can be presented in the form of a shorthand notation consisting of two or three letters. The first letter of a year type stands for Rosh Hashanah and can be ב for Monday, ג for Tuesday, ה for Thursday and ז for Saturday. The second letter of a year type stands for the length of the variable months and can be ח for חסרים 'defective', כ for כסדרן 'regular',

8. For a detailed explanation of the workings of the Jewish calendar, see R. Sar-Shalom, *Gates to the Hebrew Calendar* (in Hebrew; Netanyah: R. Sar-Shalom, 1984), esp. pp. 52, 131–40.

9. The rest of the months have a fixed length of either 29 or 30 days, in alternation.

and ש for שלמים 'full'. The third letter can represent Passover and be א for Sunday, ג for Tuesday, ה for Thursday and ז for Saturday. Alternatively, it can represent intercalation where 12-month years are marked פ for פשוטה 'plain' and 13-month years are marked מ for מעוברת or ע for עיבור 'intercalated' or 'intercalation' respectively. The third letter can be missing, and intercalation can also be registered in a separate column of pre-calculated tables. In most manuscripts of TOH, year type notation reflects Rosh Hashanah and the length of Marḥeshvan and Kislev, with intercalation indicated in a separate column. An example of such year type is בש מעוברת, which stands for a 13-month-long year beginning on a Monday, in which both Marḥeshvan and Kislev have 30 days.

Pre-calculated calendar tables are frequently accompanied by a description of the 14 possible courses of the Jewish year. Such descriptions contain information on the arrangement of months, festivals, fasts and biblical pericopes in a year of each type. Having determined the type of a year of his interest, a user can live through the liturgical year using the fuller description as a guide.

An inventory of pre-calculated calendar tables in manuscripts and prints of TOH

In all printed editions of TOH that have the pre-calculated calendar table[10] it is presented as a cycle of thirteen 19-year cycles which repeats itself four times (FIGURE 1). The table covers 5055–6042 AM, fifty-two 19-year cycles 267–318, by giving year types for thirteen 19-year cycles (247 years) and indicating that these data remain valid for four consecutive iterations covering 19-year cycles 267–279, 280–292, 293–305, 306–318).

Calendars found in manuscripts of TOH are structured differently. They are presented in TABLE 1, arranged by the covered period and alphabetically by classmark where tables cover the same 19-year cycles.

10. On editions with and without a calendar, see below.

TABLE 1 An inventory of calendar tables in manuscripts of TOH

Cycles covered	Number of cycles covered	Columns	Classmark, folio and siglum	Period	Hand and place of copying if known
264–276	13	13	Oxford, Bodleian Laud Or 166, fol. 147r (Ox 166)	1470	Ashkenazi (Germany, Fritzlar)
267–316	50	22	Cambridge, UL Add 548, fol. 148r (Camb 548)	fifteenth century	Sefaradi
267–316	50	22	Cambridge, UL Add 1199.1, fol. 150v (Camb 1199.1)	1432	Byzantine (Byzantium)
267–316	50	22	Hamburg, Stabi Cod. hebr. 34, fol. 260r–v (Hamb 34)	fourteenth–fifteenth century	Ashkenazi
267–316	50	22	Leipzig, UBL B.H. fol. 8, fol. 133v (Leipz 8)	probably before 1412	Ashkenazi (Ashkenaz)
267–316	50	22	Munich, BSB Cod. hebr. 421, fols 112v–113v (Mun 421)	fourteenth–fifteenth century	Ashkenazi
267–316	50	22	New York, JTS 8188, fol. 32r (NY 8188)	fifteenth century	Ashkenazi
267–316	50	22/13[11]	New York, JTS Rab 527, fol. 184v (NY 527)	1380	Sefardi (Sefarad)
267–316	50	22	New York, JTS Rab 1147, fol. 106v (NY 1147)	1450	Ashkenazi (Ashkenaz)
267–316	50	22	Oxford, Bodleian Mich. 127, fol. 170r–v (Ox 127)	fifteenth century	Ashkenazi
267–316	50	22	Oxford, Bodleian Opp. 51, fol. 169v (Ox 51)	1456	Ashkenazi (Ashkenaz)
267–316	50	22	Oxford, Bodleian Opp. 53, fol. 93r (Ox 53)	fourteenth–fifteenth century	Ashkenazi
267–316	50	22	Paris, BNF heb. 422, fol. 70v (Paris 422)	1487	Ashkenazi (Italy, Soncino)
267–316	50	22	Paris, BNF heb. 430, fol. 1r (Paris 430)	fifteenth century	Ashkenazi
267–316	50	22	Parma, Biblioteca Palatina Cod. Parm. 3262, fol. 85v (Parma 3262)	1459	Sefardi (Italy, Ferrara)

11. The table is planned for 22 columns covering cycles 267–316, but only 13 columns are filled.

267–316	50	22	St Petersburg, RNL Evr I 209, fol. 118v (SPB 209)	1419	Ashkenazi (Ashkenaz)
267–316	50	22	St Petersburg, RNL Evr I 210, fol. 66r (SPB 210)	fourteenth–fifteenth century	Ashkenazi
267–316	50	22	St Petersburg, RNL Evr I 211, fol. 54v (SPB 211)	fifteenth century, *c.* 1456?	Ashkenazi
267–316	50	22	Toronto, University of Toronto Friedberg 5–014, fol. 46v (Tor 5–014)	14th century?	Sefardi
267–316	50	22	Vatican, BAV Ross. 600, fol. 76v (Vat 600)	fourteenth–fifteenth century	Sefardi (tables are in a secondary, cursive Italian hand)
267–279	13	13	Hamburg, Stabi Cod. hebr. 246, fol. 56r (Hamb 246)	1463	Ashkenazi (Germany, Worms)
267–279	13	13	Oxford, Bodleian Mich. 369, fol. 71r (Ox 369)	1444	Ashkenazi, (Ashkenaz)
267–279	13	13	Paris, BNF heb. 426, fol. 102v (Paris 426)	1455	Ashkenazi, (Italy)
269–277	9	9	Bern, Burgerbibliothek Cod. 253, fol. 84r (Bern 253)	fifteenth century	Ashkenazi
269–277	9	9	Vatican, BAV Ross. 555, fol. 78r (Vat 555)	1435	Italian (Italy, Mantua)
269–277	9	9	Vienna, ONB Cod. hebr. 127, fol. 61v (Vienna 127)	1436	Ashkenazi (Ashkenaz)
269–281	13	13	Milan, Biblioteca Ambrosiana X 123 Sup, fol. 167v (Mil 123)	*c.*1479	Ashkenazi (Italy)
272–286	15	15	London, BL Add 27150, fol. 99r (Lon 27150)	1492	Italian (Italy, Carpi)
272–286	15	15	London, BL Harley 5716, fol. 100r (Lon 5716)	1475	Sefardi (Italy, Ferrara?)
274–286	13	13	Vatican, BAV ebr. 152, fol. 158r (Vat 152)	fifteenth century	Ashkenazi (Ashkenaz)
274–286	13	13	New York, JTS Rab 689, fol. 122r (NY 689)	1437	Ashkenazi (Ashkenaz)
275–277	3	3	Zurich, Braginsky Collection 124, fol. 112r (Zur 124)	*c.*1446	Ashkenazi

276–288	13	13	Paris, BNF heb. 429, fol. 48v (Paris 429)	fifteenth century	Ashkenazi
277–279	3	3	Oxford, Bodleian Mich 621, fol. 63r (Ox 621)	1494	Italian (Italy, Rieti)
278–280	3	3	Munich, BSB Cod. hebr. 255, fol. 156v (Mun 255)	fifteenth century	Sefardi (tables are in a secondary, Sefardi hand)

This inventory demonstrates that none of the tables preserved in manuscripts of TOH has the same structure or covers the same range of dates as the printed table. The printed table is not attested in manuscripts of TOH and is clearly not authorial.

The original calendar table in TOH and its transmission

Most text witnesses of TOH include a description of the pre-calculated calendar table. Unlike the calendar itself, this description has been relatively uniformly transmitted in manuscripts and prints, and although textual variation exists, it is clear that all versions stem from a single, presumably authorial source. This description is a firm basis for establishing which of the attested calendars was intended by Jacob ben Asher:[12]

> בלוח הראשון יש קביעות של כל שנה ושנה משנת חמשת אלפים ונ״ה שהיא תחלת המחזור רס״ז עד תשלום ששת אלפים שנה כל מחזור בשורה אחת וכל שורה י״ט קביעות כמנין שני המחזורים ותחת כל מחזור כמה מונין לבריאת עולם בתחלתו וכל המחזורים הכתובים בשורה אחת קביעותן שוה

> The first table[13] contains the year types of all years from the year 5055, which is the beginning of cycle 267, until the end of the sixth millennium.[14] Each 19-year cycle is in its own column[15] and each column consists of 19 year types corresponding to the number of years in a cycle. Under each cycle [is given] the date from Creation of the first year of the cycle. All the cycles that are written in one column have the same fixation.

12. Cited here according to Mun 255.

13. The second table implied here is the description of the 14 types of course of the Jewish year.

14. The end date of the table at the end of the sixth millennium is ideologically significant and links up with the belief expressed in *bSanh*. 97a that the world will exist for 6,000 years and will be desolate in the seventh millennium.

15. In pre-modern descriptions of tables the Hebrew word שורה can indicate columns as well as rows. The translation 'column' is chosen here in correspondence with the actual layout of Jacob ben Asher's table.

One type of table found in manuscripts fits this description. This is the table that covers cycles 267–316 (5055–6004) (FIGURE 2). The table starts in 5055 and goes slightly beyond the end of the sixth millennium because it is arranged by 19-year cycles and the cycle closest to the end of the sixth millennium ends in 6004. In this table identical cycles are presented in one column, whereas cycles that do not share the same sequence of year types with any other cycle covered by the table are given a separate column. 22 columns are necessary to present calendar information for 5055–6004 in this way. Within the corpus of surviving manuscripts more than a half of all manuscripts with a calendar include the 22-column table, and the table is found in copies from most geo-cultural areas. It can be concluded that the table intended by Jacob ben Asher is the 22-column table covering cycles 267–316.[16]

The 22-column table, clearly intended by Jacob ben Asher, may not have been part of his original autograph. According to Galinsky, the text of TOH exists in two recensions: a shorter recension reflecting the original text, and a longer recension, which includes various additions and clarifications.[17] Surviving manuscripts suggest that the extended recension was prepared possibly before 1347 and certainly by 1380.[18] Most manuscripts of TOH contain different mixed versions of the text that follow the short recension in some places and the extended recension in others.[19] Although both recensions include the above prose description, manuscripts of what is thought to be the original recension never contain the 22-column table itself.[20] On the other hand, manuscripts that have been classified by Galinsky as representing the extended recension or carrying a mixed version of the text include the described calendar table.[21] This indicates that the 22-column

16. The first scholars to realize that Jacob ben Asher's original table consisted of 22 columns were Rafael Gordon and Zvi Hirsch Yaffe. Their conclusions were theoretical rather than based on manuscript evidence, but were later supported by manuscripts Paris 422 and Ox 127. For references, see nn. 61, 62, 63.

17. Galinsky, 'The Four *Turim*', pp. 309–35.

18. Vidro, 'Manuscript to Print'.

19. Galinsky, 'The Four *Turim*', pp. 310–11; Vidro, 'Manuscript to Print'.

20. Sefardi manuscripts: Mun 255, Roma, Biblioteca Casanatense 3141, London, BL Harley 62. Ashkenazi and Italian manuscripts: Vienna 127, NY 689, Bern 253, Vat 555.

21. For example, Camb 1199.1, Parma 3262, SPB 209, SPB 210. Manuscript corpora analysed in Galinsky, 'The Four *Turim*' and in this article only partially overlap, so that not all manuscripts in TABLE 1 are assigned by Galinsky to one of the recensions. For a clustering of all known TOH manuscripts that have a calendar section, see Vidro, 'Manuscript to Print'.

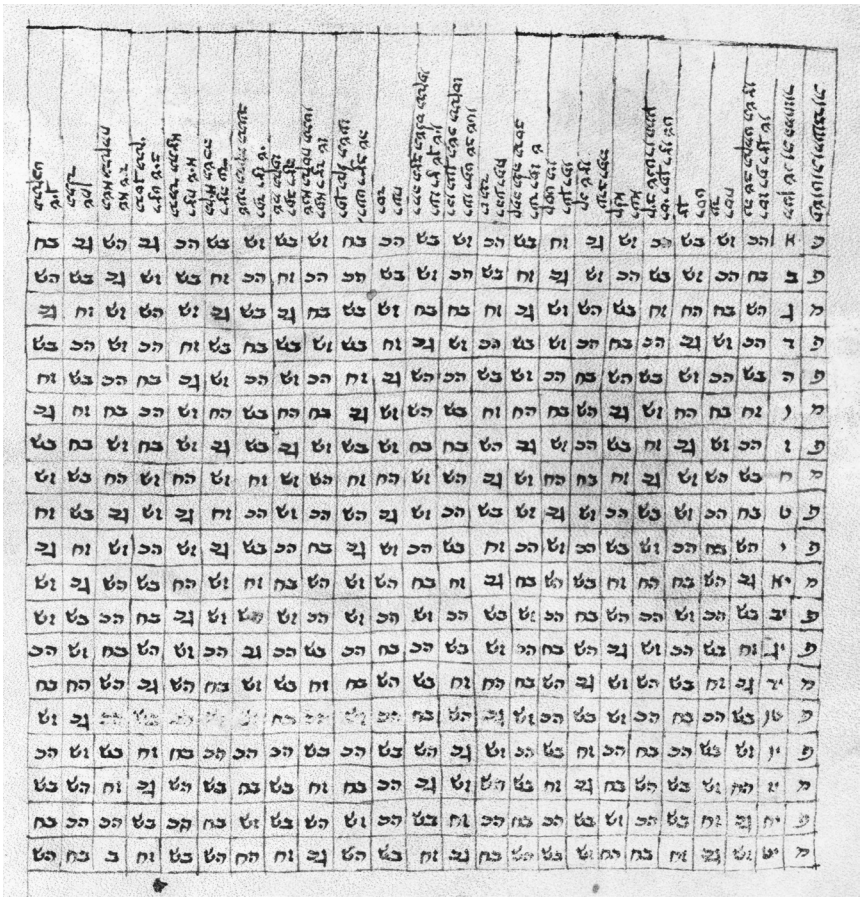

FIGURE 2 Original 22-column table of TOH. *Reproduced by kind permission of the Syndics of Cambridge University Library, MS Add 1199.1, fol. 150v.*

table for years 5055–6004 was planned from the start, but was physically included only in the extended recension, either by Jacob ben Asher himself or by his disciples.[22]

22. That whoever prepared the extended recension emended the calendar section is also shown by the second table of TOH giving details of the months, festivals and fasts for the 14 types of the Jewish year. This table is found in manuscripts of both the short and the extended recension. Short recension manuscripts never include information on the Fast of Gedaliya or Hoshanah Rabba, whereas both these days are invariably mentioned in all other manuscripts, and must have been added by the makers of the extended recension.

The original TOH table: structure, contents and sources

Let us now analyse the original TOH table. The table is arranged in 22 columns, each column covering between one and four 19-year cycles. Cycles that share a column are fixed identically and are in all cases thirteen 19-year cycles apart. For example, the first column of the 22-column table covers cycles 267, 280, 293, 306 but the second column covers only cycle 268 because cycle 281, thirteen cycles later, is not identical with it. A look at the headings of the 22-column table will make the structure of this table clear (the numeration of columns is mine and is not found in manuscripts).

TABLE 2 The structure of the 22-column table. The first, three-digit number in each cell is the number of a relevant 19-year cycle. The second, four-digit number is the date from Creation of the first year of that cycle.

1	267, 5055	280, 5302	293, 5549	306, 5796
2	268, 5074			
3	269, 5093			
4	270, 5112	283, 5359	296, 5606	309, 5853
5	271, 5131			
6	272, 5150	285, 5397		
7	273, 5169	286, 5416		
8	274, 5188	287, 5435	300, 5682	
9	275, 5207	288, 5454		
10	276, 5226	289, 5473	302, 5720	315, 5967
11	277, 5245	290, 5492	303, 5739	316, 5986
12	278, 5264			
13	279, 5283	292, 5530	305, 5777	
14	281, 5321	294, 5568	307, 5815	
15	282, 5340	295, 5587		
16	284, 5378	297, 5625	310, 5872	
17	291, 5511	304, 5758		
18	298, 5644	311, 5891		
19	299, 5663	312, 5910		
20	301, 5701	314, 5948		
21	308, 5834			
22	313, 5929			

The 22-column table is thoroughly planned and calendrically accurate in that it does not rely on the popular but faulty idea that all 19-year cycles are reiterated after thirteen cycles. However, all surviving 22-column tables are error-ridden to the extent that they deviate from the normative calendar more often than the reiterative scheme of the printed editions.

A large set of mistakes in 22-column tables are generic – that is, found in every single table without exception. These are:

1. Year types for years 9–11 of cycles 274/287/300 (column 8) are given as זש בח הכ instead of זש גכ זח respectively. These year types are not random and correspond to years 9–11 of cycle 261, thirteen cycles earlier.[23]

2. In the latter part of the table calendrical information does not correspond to data in headings:

Column number	17	18	19	20	21	22
Cycle given in the heading	291/304	298/311	299/312	301	308	313
Data for cycle	274/287/300	291/304	298/311	299/312	301	313

Hence, calendar data for cycles 274/287/300 are inserted before cycles 291/304, which pushes the whole sequence one cell ahead, and cycle 308 is omitted altogether, with the effect that in column 22 the data are correct for cycle 313. None of this is reflected in the table's headings. Noteworthy is that whereas data for cycles 274/287/300 in column 8 are copied from cycle 261 (see mistake 1 above), calendrical data given in column 17 are correct for cycles 274/287/300.

3. In the cycle labelled 299/312 (but containing calendrical data for cycle 298/311) years 6–9 are given as זש זש בח הכ instead of זש בח הכ הש. This is a clear copying mistake, whereby הש in year 6 was skipped, the sequence זש בח הכ was copied one slot too early and זש was then repeated in year 9.

4. In the cycle labelled 308 (but containing calendrical data for 301) year 7 is incorrect: בח instead of הכ.

23. This mistake is found in all manuscripts except Camb 548, where correct year types for years 9–11 of cycles 274/287/300 are provided but are clearly an emendation since they include the day of the week of Passover and consist of three letters, whereas all other year types do not.

The nature of some of these generic mistakes may give a clue about the table's source. Whereas mistakes 3 and 4 on the list are mere blunders, either authorial or scribal, mistakes 1 and 2 must have a substantial explanation. They could not have originated in the context of copying the 22-column table from one manuscript to another or, for that matter, from a draft to a fair copy. Preparing a straightforward copy, why would a copyist change calendrical information for cycles 274/287/300 to that of thirteen cycles earlier? Why would a copyist duplicate calendrical information for cycles 274/287/300 in column 17? If incidentally moving data for cycles 291/304 down by one column, why did not the copyist move the data for cycle 308 to the column labelled 313 but leave the data out altogether and include correct calendrical information for cycle 313? Why did he not write a note to say that columns slipped? Answers to these questions may be easier to find in how the TOH table was put together than in how it was copied.

The unusual format of Jacob ben Asher's table, whereby identical cycles are put together in one column instead of being written out in a consecutive way, is found in an earlier pre-calculated calendar table in the astronomical treatise *Luḥot ha-Nasi* by the twelfth-century mathematician and astronomer Abraham bar Ḥayya.[24] This table covers sixty-five cycles 257–321 (4865–6099, 1104/5–2338/9) and consists of 24 columns, each covering between one and five cycles.[25] Structural parallels between this table and the 22-column table in TOH indicate that Jacob ben Asher may have followed the model of Bar Ḥayya's table when preparing the calendar for TOH.[26] More than that, some features of Bar Ḥayya's table suggest that the data themselves – that is, the year types contained in TOH's table – come from the table in *Luḥot ha-Nasi*.

The headings of Bar Ḥayya's table are presented in TABLE 3 (the numbering of columns is mine and is not found in the manuscripts).

24. On this work, see J.M. Millás Vallicrosa, *La Obra Séfer Hešbón Mahlekot ha-Hokabim (Libro del Cálculo de los Movimientos de los Astros) de R. Abraham bar Ḥiyya ha-Bargeloní* (Barcelona: Consejo Superior de Investigaciones Cientificas, 1959), pp. 109–16; Y.T. Langermann, 'Science in the Jewish Communities of the Iberian Peninsula: An Interim Report', in idem, *The Jews and the Sciences in the Middle Ages* (Aldershot: Ashgate, 1999), pp. 15–16; N. Garstein, 'The Relationship between Abraham Bar Hiyya's Astronomical Tables and his Treatise "Calculation of the Stellar Motions"' (MA thesis, Bar Ilan University, 2016).

25. See, for example, Paris, BNF heb. 1046, fol. 2r.

26. See also Raviv, 'Mathematical Studies', p. 106.

TABLE 3 The structure of the calendar table in *Luḥot ha-Nasi* by Abraham bar Ḥayya. The number in each cell is the number of a relevant 19-year cycle.

1	257				
2	258	271			
3	259	272	285		
4	260	273	286		
5	261	308	321		
6	262	275	288		
7	263	276	289	302	315
8	264	277	290	303	316
9	265	278			
10	266	279	292	305	
11	267	280	293	306	319
12	268				
13	269				
14	270	283	296	309	
15	274	287	300		
16	281	294	307	320	
17	282	295			
18	284	297	310		
19	291	304	317		
20	298	311			
21	299	312			
22	301	314			
23	313				
24	318				

This table has a very unusual feature. In the Jewish calendar most, albeit not all, 19-year cycles are identical with other cycles thirteen (and sometimes also multiples of thirteen) cycles away. It is much rarer for a 19-year cycle to be identical with a cycle which is not thirteen (or a multiple of thirteen) cycles away. One such rare case are cycles 261 and 308, which are identical but are forty-seven cycles away.[27] On the other hand, these same cycles differ from cycles that are a multiple of thirteen cycles away: cycle 261 differs from later

27. See Sar-Shalom, *Gates*, pp. 186–8.

cycles 274, 287 and 300, whereas cycle 308 differs from earlier cycles 282 and 295 (but is identical with cycle 321). Due to this situation, in Bar Ḥayya's table cycles 261 and 308 share a column (column 5), cycles 274/287/300 get a column of their own (column 15), and there is no need for a separate column for cycle 308 between cycles 301 (column 22) and 313 (column 23).

That cycles 261 and 308 should share a column must have seemed a mistake to some scribes. In a group of manuscripts of *Luḥot ha-Nasi* the heading is emended to read 261/274/287 over column 5 (erroneously equating cycles 274 and 287 with cycle 261).[28] The structure of the table is not modified so that column 15 still contains the correct data for cycles 274/287/300 (seemingly a re-duplication) and no column is introduced for cycles 308/321 between cycles 301 and 313 (so that cycle 308 is no longer marked in the heading at all, making it unclear how this cycle is fixed). This pattern is clearly echoed in the generic mistakes in the 22-column table of TOH, where year types for cycles 274/287/300 are copied from cycle 261, thirteen cycles earlier (mistake 1); correct calendar data for cycles 274/287/300 are inserted before cycles 291/304, and cycle 308 is omitted altogether (mistake 2). This intimates that the 22-column table in TOH is based on the table in *Luḥot ha-Nasi*, with data somewhat uncritically extracted, either by relying on a faulty copy of Bar Ḥayya's work or by making the same unwarranted emendations.[29]

28. See London, BL Or. 11796, fols 3r–4r and Oxford, Bodleian Hunt. 327, fols 3r–4r.

29. Yaffe (*Qorot*, pp. 164–5) suggested an alternative explanation for these mistakes, based on a study of two manuscripts, Paris 422 and Ox 127. According to him, Jacob ben Asher prepared two different 22-column tables: Table A for cycles 267–316 and, later, Table B for cycles 258–316 (extending Table A to the past so that it would start in the same cycle as the table in Abraham bar Ḥayya's *Sefer ha-ʿIbbur*). Calendar data for cycle ranges 267–316 and 258–316 are such that it was possible for Jacob ben Asher to represent them by the same 22 columns, albeit arranged in a slightly different order. Yaffe hypothesized that in Table B, covering cycles 258–316, the order of columns was the same as is found in Paris 422 and Ox 127 but its heading was different, and the table's heading and body matched each other perfectly. In Table A covering cycles 267–316 the order of columns was different from the attested order, but the heading was identical with that found in Paris 422 and Ox 127 and given above in TABLE 1, so that again the table's heading and body matched each other perfectly. Having posited these two hypothetical tables, Yaffe suggested that the scribes of manuscripts Paris 422 and Ox 127 took the heading of Table A and erroneously applied it to the body of Table B, thus creating the table now attested in the manuscripts. This suggestion, although calendrically sound, is highly unlikely. First, the present study shows that the discussed mistakes are generic and as such cannot be traced back to copyists of individual manuscripts. They must have originated with the earliest version of the 22-column table for cycles 267–316. Second, and most significantly, Yaffe's Tables A and B are purely hypothetical and are not attested in any of the 35 surviving manuscripts that have a calendar table. Moreover, a table for cycles 258–316 is not mentioned in TOH. Third, it is unclear for what purpose Jacob ben Asher would put together a calendar covering past cycles. In Yaffe's reasoning he did so simply because it was calendrically easy – an implausible argument when

Non-scribal generic (i.e. found in all surviving copies) calendar mistakes are not exclusive to TOH. They also occur in scientific calendar treatises, such as *Yesod ʿOlam*, a comprehensive monograph on mathematics, astronomy and calendar by Isaac Israeli composed in 1310;[30] and *Ḥeshev ha-Efod*, a calendar monograph by Profiat Duran composed in 1395.[31] In particular, tables in *Yesod ʿOlam* and *Ḥeshev ha-Efod* have generic mistakes linked to reusing old calendrical information from thirteen or a multiple of thirteen cycles earlier.[32] At the same time, both authors explicitly state that the Jewish calendar does not recur after thirteen cycles and warn that relying on calendrical information for thirteen cycles earlier leads to mistakes.[33] This raises questions regarding how calendar tables were put together. It is possible that authors decided on the range of cycles to be covered as well as the table's structure, leaving the preparation of actual data to more or less skilled amanuenses. This would be similar to the well-attested scenario when authors delivered incomplete autographs to fair copy scribes whose responsibility it was to insert missing passages (for example, quotations from other books).[34] This conjecture is supported by the fact that a pre-calculated calendar was planned but not included in the original recension of TOH.

The transmission of the 22-column table

As the 22-column tables were copied, additional mistakes accumulated, enabling us to identify two table families: family 1 that consists of manuscripts from Ashkenaz, Sefarad, Italy and Byzantium; and family 2 that is purely Ashkenazi.[35] Interestingly, the spread of Jacob ben Asher's table was not

applied to a practical Halakhic work, and a practice hardly attested in medieval Jewish sources other than when copying an older table.

30. Edited in B. Goldberg and A. Rosenkranz, *Yesod ʿOlam* (in Hebrew; Berlin: Sumptibus editorum, 1848). A new annotated edition and translation of *Yesod ʿOlam* is in preparation by Israel Sandman and Ilana Wartenberg (UCL).

31. On this work, see M. Kozodoy, *The Secret Faith of Maestre Honoratus: Profayt Duran and Jewish Identity in Late Medieval Iberia* (Philadelphia PA: University of Pennsylvania Press, 2015), pp. 104–14.

32. The table in *Yesod ʿOlam* covers 19-year cycles 268–300 and has generic mistakes linked to using outdated year types in cycles 274, 281, 282 and 287 but not in cycles 284, 291, 294, 295, 298, 299 and 300, where such mistakes are also possible (see, for example, London, BL Add 15977, fol. 178r). The table in *Ḥeshev ha-Efod* covers cycles 272–281 and has generic mistakes linked to using outdated year types in cycle 281 (see, for example, Parma, Biblioteca Palatina Cod. Parm. 2776, fol. 130v).

33. *Yesod ʿOlam*, bk 4, sect. 10; *Ḥeshev ha-Efod*, ch. 22.

34. C. Sirat, *Hebrew Manuscripts of the Middle Ages* (trans. N. de Lange; Cambridge: Cambridge University Press, 2002), pp. 279, 282.

35. Family 1 is made up of three sub-families: 1a. Ox 127 (Ashkenazi hand), Paris 422 (Ashkenazi

limited to copies of TOH alone. A Halakhic code *Tsedah la-Derekh* composed by Menaḥem ben Aharon ibn Zeraḥ in Toledo in 1370s includes calendar tables and their prose description that are clearly borrowed from TOH.[36] 22-column tables in copies of this code belong to family 1 of TOH and are closest to the table in Tor 5–014.

The 22-column table's economical but counter-intuitive layout, whereby cycles are not listed consecutively but are grouped with other identical cycles, disturbed some scribes and users. We see perplexity over the table's format in Tor 5–014, where a user tried to change the header of cycle 281 beginning in 5321 to cycle 280 beginning in 5302, and the header of cycle 282 beginning in 5340 to cycle 281 beginning in 5321 in order to restore the natural order of cycles 279, 280, 281 (see FIGURE 3). A misunderstanding of the table's structure is also obvious in NY 1147, where a secondary heading forced on the table by a later reader specifies one cycle per column and runs consecutively from cycle 267 to cycle 288, with the effect that from column 14 headings have nothing in common with data.

In a group of Ashkenazi manuscripts the 22-column table was shortened to a table of thirteen columns covering 19-year cycles 267–279 (see Ox 369, Paris 426 and Hamb 246). This table begins in the same cycle as the original 22-column table, includes its first thirteen columns that still cover 19-year cycles consecutively, and shares mistakes with a sub-family of 22-column tables represented by Camb 548 and SPB 210.[37] The new table was almost certainly intended to be used reiteratively. This is suggested by its coverage of precisely thirteen 19-year cycles and confirmed by the table's heading in Hamb 246 where cycle numbers are indicated for at least two iterations. The shortened reiterative calendar for thirteen 19-year cycles 267–279 is the only

hand in Italy), Tor 5–014 (Sefardi hand), Camb 1199.1 (Byzantine hand); 1b. Parma 3262 (Sefardi hand in Italy), Vat 600 (Sefardi-hand manuscript with a secondary table in Italian cursive), Hamb 34 (Ashkenazi hand) and NY 8188 (Ashkenazi hand); 1c. SPB 210 (Ashkenazi hand) and Camb 548 (Sefardi hand, maybe copied in Italy), which combine family 1a mistakes with some of the family 1b mistakes and also have links with the second family. Family 2 includes Leipz 8, Ox 51, SPB 211, NY 1147, Ox 53, SPB 209 and Mun 421 (all copied in Ashkenazi hands).

36. On this code and its relationship with TOH, see S. Eidelberg, 'On Menahem Ben Aaron Ibn Zerah and His Book "Zeidah la-Derekh"', in *Proceedings of the 6th World Congress of Jewish Studies*, vol. 3 (Jerusalem: World Union of Jewish Studies, 1973), pp. 15–30; and Galinsky, 'On the Circulation', p. 27. The 22-column table and its prose description are found in pt 4, rule 2, sect. 10 of the work and are preserved in Oxford, Bodleian Mich 417, fol. 142r, and New York, JTS Rab. 1117. On the printed table in *Tsedah la-Derekh*, see below, p. 81.

37. Family 1c (see n. 35).

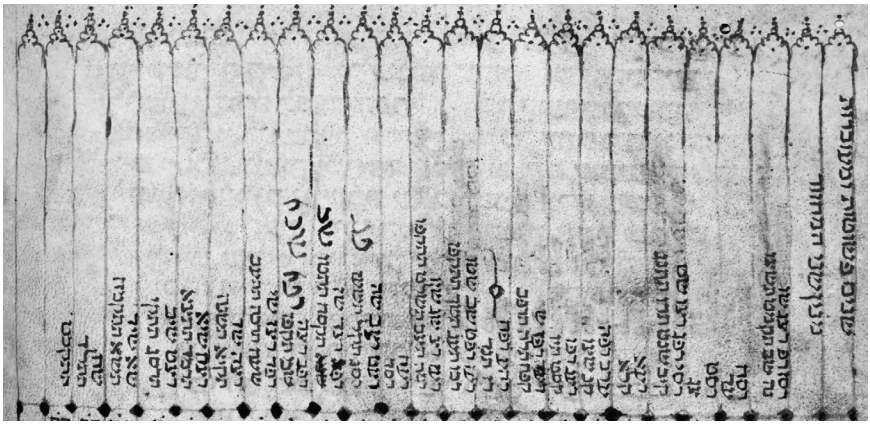

FIGURE 3 Corrections to the header of the 22-column table made by a later user. *The Thomas Fisher Rare Book Library, University of Toronto, MS Friedberg 5–014, fol. 46v (detail).*

type of manuscript calendar in TOH that resembles the reiterative calendar in printed editions of TOH.[38]

A variety of tables are attested in copies of TOH alongside the 22-column table and its shortened reiterative version (see TABLE 1), testifying to scribes' freedom to choose calendar tables.[39] This prerogative is particularly conspicuous in manuscripts with similar textual variants in the description of tables but different pre-calculated calendars. A cluster of manuscripts with a distinct version of the prose text[40] – Ox 621; Paris 426; SPB 210; Strasbourg, BNU 4.016, fol. 13v; Cambridge, UL Add 656, fol. 128r; and Zur 124, – includes manuscripts with the 22-column table; a shortened reiterative version of this table; two different alternative tables; and no table at all. Although not copying the 22-column table could be ad hoc, some manuscripts with an alternative or a lacking table probably stem from an early progenitor without

38. Similarly structured tables in copies of Bar Ḥayya's *Luḥot ha-Nasi* also show attempts to make sense of the unusual layout, including relabelling columns to make cycles appear in a numerical succession (Paris, BNF, heb. 1045, fols 1v, 13v), making groups of columns represent an identical number of cycles (London, BL Or. 11796, fols 3r–4r), and turning the table into a reiterative calendar (Cesena, Biblioteca Malatestiana Pluteo sinistro XXIX 4, fol. 3v; Parma, Biblioteca Palatina Cod. Parm. 3821, fol. 10v; and Oxford, Bodleian Marsh. 114, fol. 22r).

39. See also I.M. Sandman, 'Scribal Prerogative in Modifying Calendrical Tables', in S. Stern and C. Burnett (eds), *Time, Astronomy, and Calendars in the Jewish Tradition* (Leiden: Brill, 2014), pp. 113–54.

40. See Vidro, 'Manuscript to Print'.

a calendar. While copied and used, such manuscripts could be provided with a calendar,[41] sometimes in a secondary hand,[42] which could then be faithfully copied by a next scribe[43] or updated to suit a new period of copying.[44]

The original 22-column table and the vast majority of alternative tables are ridden with mistakes, including mistakes in the calendar of the actual year of copying. It appears that scribes did not see themselves responsible for the calendrical accuracy of copied tables. In fact, some scribes may not have been able to discern or correct calendar mistakes at all: many tables are filled with year types that do not exist (for example, בה and זה instead of בח and זח respectively in Parma 3262), or year types for plain years are given in intercalated years and vice versa. Occasionally scribes made comparisons between different tables and recorded alternatives in marginal glosses, leaving it for users to decide which data to follow. These alternatives refer both to correct and to incorrect year types, demonstrating either a lack of calendrical knowledge or a disinterest in providing a definitive calendar.[45] Even where scribes could easily check calendrical data, they made little effort to do so. To proofread the heading of a 22-column table, all a scribe needs is to perform simple additions, but still headings are full of mistakes both in cycle numbers and in dates from Creation. Headings can also be added to wrong columns: in Ox 369, copied in 1444 (cycle 274), only cycles 272–274 are indicated but these are written over cycles 271–273 – that is, the copyist marked his

41. Bern 253, Vat 555 and Vienna 127 represent the Ashkenazi–Italian branch of the short recension of TOH (Galinsky, 'The Four *Turim*', p. 312) that was first published without a calendar table (see above, pp. 67–8). All these manuscripts, copied in the fifteenth century, contain an identical alternative table that starts in 1332/3 and must have entered the transmission of TOH around that time.

42. In Sefardi manuscripts Mun 255 and Vat 600, empty pages left where a calendar table is expected were later filled with tables in secondary hands.

43. See Lon 27150, which has the same non-authorial table for fifteen cycles as its source, Lon 5716.

44. Manuscripts NY 689 and Vienna 127 were copied by the same scribe. Vienna 127, copied in 1436, comes with a calendar for cycles 269–277 (1332/3–1502/3), which was largely outdated at the time of copying. On the contrary, NY 689, copied one year later, contains a calendar for cycles 274–286 (1427/8–1673/4), which starts in the 19-year cycle when the manuscript was copied.

45. NY 689 and Vat 152, copied by the same scribe, Jacob Ḥalfon, contain identical calendar tables for cycles 274–286 (1427/8–1673/4) with mistakes in years 7 and 8 of cycle 275. In both manuscripts mistaken year types are marked with small red circles and correct year types are written in Jacob Ḥalfon's hand in the margins of the table. On the other hand, cycle 281 is copied correctly in both manuscripts but year types for years 17 and 18, when cycle 281 differs from cycle 268, thirteen cycles earlier, are again marked with small red circles and outdated year types for cycle 268 are given in the margins. Jacob Ḥalfon must have compared the table that he was copying with another table and noted the differences, without committing himself to either option.

own cycle incorrectly. Glaring mistakes and alternative data are found in manuscripts of other works, too. Manuscript Parma, Biblioteca Palatina Cod. Parm. 2776, fol. 130v of *Ḥeshev ha-Efod* by Profiat Duran fixes the year 5245 as דש with Rosh Hashanah on a Wednesday, violating the famous calendrical rule *lo ADU Rosh*. The richly illuminated Rothschild miscellany (Jerusalem Museum 180/51) gives alternative calendar data in the margins, introduced with סברה אחרת, 'in another opinion'.

Although corrupt, tables of all types show signs of having been consulted. While some users were able to improve a table's reading,[46] others introduced new mistakes,[47] or distorted headings.[48] Like the scribes, many users of TOH appear to have lacked calendrical expertise.

The calendar in printed editions of TOH

TOH was printed at least 25 times during the fifteenth and sixteenth centuries, both as part of the full *Arbaʿah Ṭurim* and as a separate book.[49] A survey of the imprints shows that editions printed in the incunabula period do not include calendar tables. The first imprint to come with a set of tables is the Constantinople 1540 edition by Eliezer Soncino, the son of the famous

46. In all 22-column tables belonging to the second family (see n. 35) erroneous year types are given in rows representing years 12 and 18 of the 19-year cycles 277–291 and 276–298 respectively. In SPB 209 mistakes in cycle 277 years 12 and 18 have been corrected by a later user, presumably on the basis of a calculation of *moladot* for cycles 277 and 278 that he penned in the copy.

47. Paris 426 comes with a reiterative table for thirteen 19-year cycles 267–279. In this table a number of corrections were made in a secondary hand, in most cases replacing correct year types with erroneous ones, or substituting one set of erroneous year types with another set that is equally unsuitable. A user of the 22-column table in NY 1147 corrected year types of some years in cycles 276 and 278. Whereas the relevant year type in cycle 276 is, indeed, faulty and the reader's gloss corrects this mistake, the year type in cycle 278 is correct and the gloss is erroneous.

48. See above on the alterations made to the heading of the 22-column tables in Tor 5–014 and NY 1147.

49. Piove di Sacco 1475, Mantua 1476, Hijar 1485, Spain (or Portugal) 1490, Soncino 1490, Naples 1492, Constantinople 1493, Leiria 1495, Brescia 1497 (also known in catalogues as Italy, Soncino family), Fano 1516, Venice 1522, Salonika 1530, Cracow 1538, Prague 1540, Augsburg 1540, Constantinople 1540, Venice 1550, Cremona 1558 (two editions), Riva di Trento 1560, Riva di Trento 1561, Venice 1563, Venice 1566, Venice 1589, Lublin 1599. See *Bibliography of the Hebrew Book 1470–1960* (http://web.nli.org.il/sites/NLI/English/infochannels/Catalogs/bibliographic-databases/Pages/the-hebrew-book.aspx; accessed 29 January 2018); *British Library Incunabula Short Title Catalogue* (http://data.cerl.org/istc/_search; accessed 29 January 2018); *Gesamtkatalog der Wiegendrücke* (www.gesamtkatalogderwiegendrucke.de; accessed 29 January 2018); Y. Vinograd, *Thesaurus of the Hebrew Book* (in Hebrew; Jerusalem: Institute for Computerized Bibliography, 1993); M.J. Heller, *The Sixteenth Century Hebrew Book: An Abridged Thesaurus* (Leiden: Brill, 2004).

Gershom Soncino.[50] In Constantinople 1540 the pre-calculated calendar table has the shape familiar to all modern users of the printed TOH. It is a table for 19-year cycles 267–318 arranged as four iterations of the 247-year cycle: 267–279, 280–292, 293–305, 306–318 (see FIGURE 1).

The four-iterational printed calendar does not have an obvious predecessor in the manuscript tradition of TOH. It is clearly different from Jacob ben Asher's original 22-column table (see FIGURE 2): the printed table follows a different logic, consists of 13 rather than 22 columns and covers two additional 19-year cycles, 317 and 318, included in order to complete the fourth iteration of the 247-year cycle. The printed table is closest to the manuscript table for thirteen 19-year cycles 267–279, derived from the original 22 columns. However, calendar data in the manuscript and printed thirteen 19-year cycle tables are very different. As mentioned above, the Jewish calendar is not truly reiterative, and the actual year types given in a 247-year table can fit one and only one of its iterations, producing mistakes if applied to other iterations of the so-called cycle. In all known copies, the manuscript reiterative table contains data for cycles 267–279, with year types for cycle 274 copied over from cycle 261, and a range of other family mistakes. 19-year cycles 267–279 correspond to the first iteration of the printed TOH calendar. In the printed table, year types are correct for the second iteration of the calendar, 19-year cycles 280–292, with the exception of 19-year cycle 291 where data for 19-year cycle 278, thirteen cycles earlier, are provided instead.[51] In addition, the printed table comes with a prominent heading for four iterations; whereas in manuscript, two out of the three surviving copies do not have a multi-iterational heading and in the third it is marked in most columns for two iterations only. In the absence of data and layout correlation between the printed and the manuscript 247-year cycles, it seems more likely that they are independent parallel developments.

A previously expressed assumption that TOH printers took the table from printed *Sifre Evronot* is unlikely.[52] The first printed *Sefer Evronot* was issued

50. On the Soncino family of printers, see A.M. Habermann, *Studies in the History of Hebrew Printers and Books* (in Hebrew; Jerusalem: Rubin Mass 1978), pp. 13–96. Hypothetically, an earlier edition, Naples 1492 printed by Joshua Soncino, could have had calendar tables. Only one copy of this edition survives in a public institution and in this copy the entire calendar section has been lost (*Gesamtkatalog der Wiegendrücke* [online], number 13766; accessed 29 January 2018).

51. The second iteration of this 247-year cycle differs from the first in 19-year cycles 281, 282, 284 and 291.

52. Silber, *Berur Halakha*, p. 200.

by Sebastian Muenster for Christians, in Basel in 1527, and has no table at all.[53] The first *Sefer Evronot* printed for a Jewish readership was issued by Jacob Marcaria in Riva di Trento in 1561, after TOH was published with a calendar table in 1540. Marcaria's *Sefer Evronot* has a reiterative calendar entitled *ʿIggul de-Rav Naḥshon*, which fits 19-year cycles 267–279 with data in cycle 274 copied over from cycle 261, and is printed without a heading. It differs both in layout and in data from the printed TOH table.

The question arises: why were no calendars included in early imprints and why was it not the original 22-column table that was finally printed? Technical difficulties of printing tabulated text may have played a role, but there seem to be textual reasons, too. A comparison of chapter 428 (calendar tables and their description) in fifteenth- to sixteenth-century imprints and in surviving manuscripts demonstrates that in all imprints the text of this chapter is based on manuscripts that do not include the 22-column table. Imprints before Soncino 1490 are independent and each reproduces the text of a particular manuscript or group of manuscripts.[54] Soncino 1490 is based on manuscripts from different families of the original recension, and is the basis for all but one subsequent fifteenth–sixteenth-century imprints, including Constantinople 1540. Importantly all manuscript groups underlying the printed editions either lack a calendar altogether or provide alternative tables incongruous with the prose description. Although there is not enough evidence to claim that printers never saw the 22-column table, it was clearly not part of their main sources and, if known, contended with other manuscript tables of more usual format.

It appears that instead of reproducing the manuscripts the makers of the reiterative printed table simply followed the prose description and constructed a new table, filling it with calendar data relevant for their time. The printed table suits the prose description in that it starts in the indicated year (5055, year 1 of cycle 267) and tries to conform to Jacob ben Asher's wording 'all cycles that are written in one column have the same fixation' by taking it to mean that all cycles share a column with other cycles and that the table is intended to be cyclical. This interpretation was natural for anybody familiar with 247-year reiterative calendar tables, which medieval and early modern

53. See E. Carlebach, *Palaces of Time: Jewish Calendar and Culture in Early Modern Europe* (Cambridge MA and London: Belknap, 2011), pp. 50–51.
54. Vidro, 'Manuscript to Print'.

Jews certainly were: calendars of this type were a staple of manuscript calendrical literature, with over 200 examples surviving to this day[55] and first printed as early as 1482.[56]

The publication year of Constantinople 1540 is the obvious *terminus ante quem* for the creation of the four-iterational printed table. A more accurate dating can be given if we assume that year types for the new printed table were purposefully calculated. As mentioned above, year types given in the printed TOH calendar table fit 19-year cycles 280–292, with the exception that in cycle 291 data for cycle 278, thirteen cycles earlier, are provided instead. The inclusion of data for cycle 278 (1503/4–1521/2) in a freshly calculated table means that the table was prepared before cycle 278 has passed – that is, before the end of 1522. If, on the other hand, year types for the new printed calendar were copied from a pre-existing table for a similar range of cycles, the same reasoning would not apply and 1540 would remain the only *terminus ante quem*.

After the Constantinople 1540 edition, calendar tables appear in many but not all sixteenth-century imprints of TOH, namely Cremona 1558, Riva di Trento 1560, Venice 1566 and Venice 1589. A comparison of the layout and calendrical data in 247-year reiterative tables in these editions makes it clear that all of them come from the calendar printed in 1540.[57] Interestingly, this table was also included in the Sabbioneta 1567 edition of Menaḥem ben Aharon ibn Zeraḥ's *Tsedah la-Derekh*, initially printed in 1554 without calendar tables. Calendar tables in *Tsedah la-Derekh* followed the path of those in TOH: from the 22-column TOH table in manuscripts of *Tsedah la-Derekh*, through a printed edition without a calendar, to an edition with the reiterative 247-year calendar of printed TOH.[58] In the Venice 1589 imprint of TOH the table was updated, and year types for 19-year cycle 278 found in all other sixteenth-century editions were replaced with those for cycle 291.

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55. This estimate is based on my research on calendar cycles in medieval Jewish manuscripts in the ERC-funded project 'Calendars in Late Antiquity and the Middle Ages: Standardisation and Fixation' that ran at UCL between 2013 and 2018 (PI: Sacha Stern).

56. Guadalajara 1482(?), possibly by Solomon Alkabiz (*Gesamtkatalog der Wiegendrücke* [online], number M1603320; accessed 29 January 2018). A calendar treatise *She'erit Yosef* by Joseph ben Shem Ṭov ben Jeshua Hai printed in Salonika in 1521 also contains a table for thirteen 19-year cycles. In both imprints the calendar is said to be reiterative (חוזר חלילה).

57. A sporadic check of later editions leads to the same conclusion.

58. It must be significant in this context that the Cremona 1558 edition of TOH and the Sabbioneta 1567 edition of *Tsedah la-Derekh* were printed by the same printer, Vincenzo Conti.

This correction later shows up in such imprints as Berlin 1702 and Warsaw 1861 but not, for example, in Hanau 1610.

The four-iterational printed table soon came to be considered Jacob ben Asher's original calendar. Starting with Mordecai Yoffe's *Levush Malkhut*, published in 1590, early modern commentators of TOH never mentioned and were probably not aware of the 22-column table or any of its alternatives found in manuscripts. The most authoritative refutation of the calendar in TOH was written by Hezekiah da Silva, who in *Peri Ḥadash* on TOH chapter 428 criticized the use of the 247-year cycle and provided a non-cyclical calendar 'up to the end of the world'.[59] In footnotes to his calendar Da Silva referenced mistakes in the calendar of TOH. From this passage it is not only obvious that Da Silva consulted a reiterative calendar in a printed TOH but also the exact edition used by him can be identified since mistakes mentioned by Da Silva are identical with those found in Venice 1566, calendrically the most corrupt of all sixteenth-century editions.[60]

It was not until the twentieth century that the 22-column table was rediscovered by Zvi Hirsch Yaffe and Rafael Gordon. In 1902 TOH calendar for 1902 and 1903 was found to disagree with almanac data for these years, resulting in a lively correspondence in the pages of *Ha-Melits*, the first Hebrew periodical in the Russian Empire.[61] In the course of this discussion it was intuited that the description of tables could be read in a non-reiterative way, and the 22-column table was hypothetically reconstructed.[62] This reconstruction was confirmed by manuscript findings announced some 30 years later.[63]

The transmission history of the calendar tables in TOH does not stop here. Surprisingly, the printed table made its way back into manuscripts, albeit not manuscripts of TOH. It became an integral part of *Sifre Evronot*, early modern manuscript compendia on calendar that developed in Ashkenaz in the middle of the sixteenth century and reached their bloom in the seventeenth

59. First published in Amsterdam 1706, fols 5r–6v.

60. This edition was reprinted in Venice 1589 (*Bibliography of the Hebrew Book* [online], number 000136092; accessed 29 January 2018) but without the mistakes and, to the best of my knowledge, was never reprinted again.

61. See *Ha-Melits*, 4 (17) March–9 (22) June 1902. Available on the *Historical Jewish Press* website at http://web.nli.org.il/sites/JPress/English/Pages/default.aspx; accessed 29 January 2018. In *Ha-Melits* Julian dates were used, and Gregorian dates were given in brackets; I have followed the same system when referring to the periodical. The online archive is organized by Gregorian date.

62. R. Gordon, 'In Addition to Issue 112', *Ha-Melits*, 9 (22) June 1902, p. 3 (http://web.nli.org.il/sites/JPress/english/Pages/default.aspx; accessed 29 January 2018).

63. Yaffe, *Qorot*, p. 164.

and eighteenth centuries.[64] One look at the reiterative calendar tables in *Sifre Evronot* such as that in FIGURE 4 is enough to convince one that these tables are the same as the printed TOH table. Not only their format is identical with that of the printed TOH table but the calendrical contents are also the same. The table in *Sifre Evronot* covers 19-year cycles 267–318 in a reiterative manner – that is, in four iterations of the 247-year cycle. The data fit the second announced iteration, 19-year cycles 280–292, but cycle 291 has a mistake of reusing calendar data from cycle 278. This is the same as in all printed tables at least until Hanau 1610, with the exception of Venice 1589. The movement of this material must have been from print to manuscript rather than vice versa since *Sifre Evronot* appear to have originated after the printed TOH calendar was published in 1540.[65] More importantly, sixteenth-century *Sifre Evronot* do not feature the four-iterational table of the printed TOH but include a different reiterative calendar, whereas in seventeenth-century manuscripts the four-iterational table is regularly present.[66]

Conclusion

In this article I have investigated the creation, transmission and evolution of the pre-calculated calendar table in TOH, chapter 428, on the basis of all known manuscripts and fifteenth- to sixteenth-century printed editions of TOH. My analysis demonstrates that Jacob ben Asher's original calendar was a table that covers 5055-6004 AM (19-year cycles 267–316) in a non-reiterative way and is arranged in 22 columns. This table was derived from Abraham bar Ḥayya's calendar in *Luḥot ha-Nasi* and, although based on the normative principles of rabbinic calendar reckoning, has a set of mistakes that originated in the process of its creation and are present in all surviving copies. TOH's original table was later incorporated by Menaḥem ben Aharon ibn Zeraḥ in *Tsedah la-Derekh*. Alternative calendar tables of many different types are attested in manuscripts of TOH, some developed on the basis of the original table, others independently. In all printed editions with a calendar table, the original 22-column table was replaced with a reiterative 13-column table for

64. Carlebach, *Palaces of Time*, pp. 72–9.
65. *Sifre Evronot* commonly use 'the present year' when exemplifying calendrical procedures, and 1552 seems to be the earliest year mentioned. See Carlebach, *Palaces of Time*, p. 77.
66. The earliest *Sefer Evronot* with the four-iterational calendar known to me is Oxford, Bodleian Opp. 698, fol. 24v, which uses year 1606 in its examples (FIGURE 4).

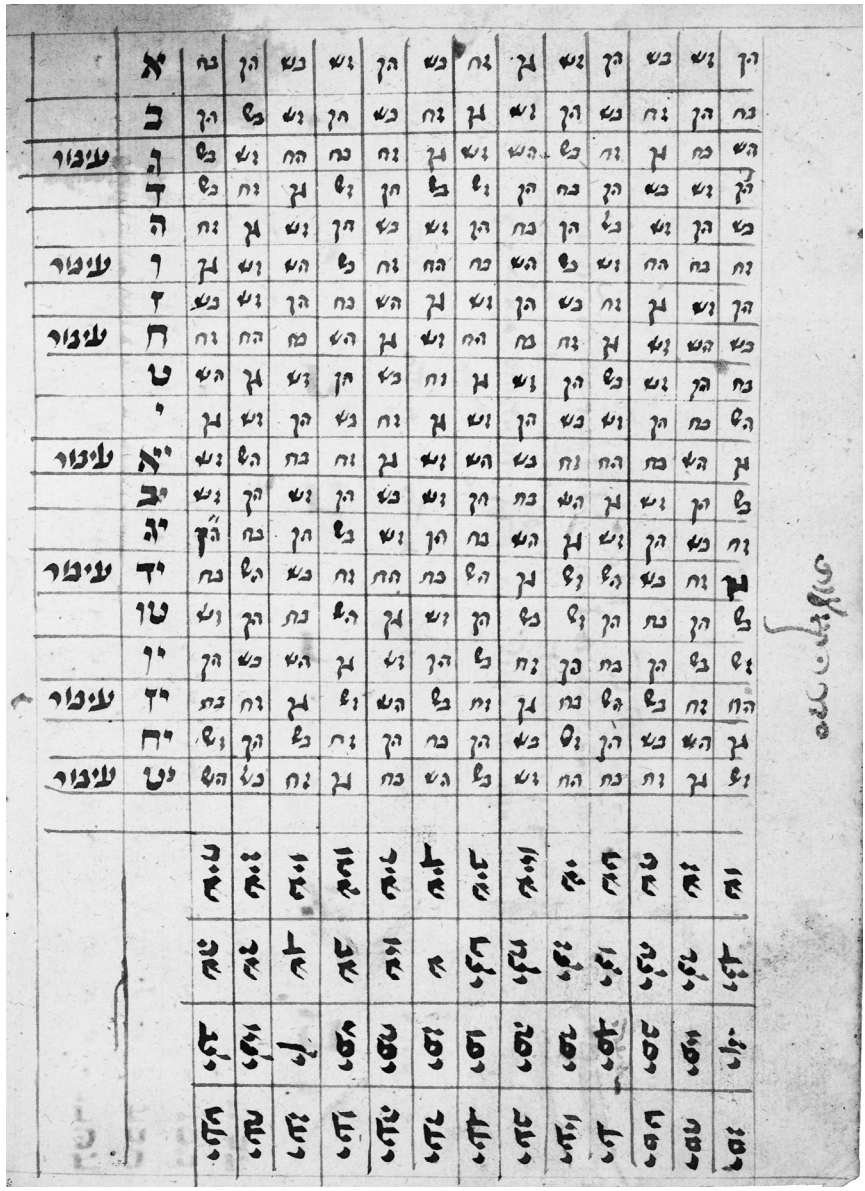

FIGURE 4 Four-iterational calendar table in a *Sefer Evronot*. *Bodleian Libraries, University of Oxford, MS. Opp. 698, fol. 24v.*

247 years claimed to be valid for four consecutive iterations. This table is not attested in the manuscript corpus and appears to have been reconstructed on the basis of the prose description of the table, understood to describe a reiterative calendar under the influence of the popular 247-year cycle known as *ʿIggul de-Rav Naḥshon*. The reconstructed reiterative table came to be considered Jacob ben Asher's original calendar by the end of the sixteenth century at the latest.

Intended as a case study, this research highlights two phenomena. The first is the mobile nature of calendar tables and their unstable connection with authorial compositions. Authors could include in their books calendar tables devised for a different work; scribes and printers had the freedom to modify or replace tables included in the authorial text, and printed tables could be reintroduced into manuscripts. The second phenomenon is the lack of calendar expertise among copyists, users and perhaps even some makers of calendar tables or their amanuenses. Glaring mistakes are found in tables included in scientific and Halakhic books, which were neither corrected nor commented upon. It remains to be investigated who had enough calendar knowledge to produce, correct or at least spot mistakes in a calendar table, and, more generally, how medieval and early modern Jews learned to fix the calendar.