



HAL
open science

The MBH Project and the Systematic Study of Late Mediaeval Hebrew Bibles: New Perspectives and 3D Experiments

Elodie Attia, Léo Pascal

► **To cite this version:**

Elodie Attia, Léo Pascal. The MBH Project and the Systematic Study of Late Mediaeval Hebrew Bibles: New Perspectives and 3D Experiments. Elodie Attia, Antony Perrot. The Hebrew Bible Manuscripts: A Millennium, Supplements to the Textual History of the Bible (6), Brill, pp.349-373, 2022, The Hebrew Bible Manuscripts: A Millennium, 978-90-04-49872-3. hal-03494763

HAL Id: hal-03494763

<https://amu.hal.science/hal-03494763>

Submitted on 3 Feb 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Chapter 12 The MBH Project and the Systematic Study of Late Mediaeval Hebrew Bibles: New Perspectives and 3D Experiments

Élodie ATTIA, Léo PASCAL

Version auteur / 15 Septembre 2021 / published in 2022 / (with few updates in 2023)

1. The *Manuscripta Bibliae Hebraicae* (MBH) Project: Corpuses and Perspectives

The MBH Project funded by the French National Research Agency (ANR) focuses on one of the most important texts produced in medieval Western European culture: the Hebrew Bible, a common cultural monument to both Jewish and Christian cultures. It has been already underlined that an up-to-date systematic study of medieval Hebrew Bibles remains a *desideratum*.¹ This research represents a large, vast, and long-lasting work effort, itself part of the general study of medieval Bibles.² By focusing first on a limited corpus of Hebrew biblical manuscripts, all produced in Western Europe up to 1300, and by using renewed quantitative approaches,³ the MBH project aims to better grasp and understand the materialization of the biblical text, i.e. forms and functions of biblical manuscripts,⁴ their social and cultural meaning,

*Research Member of the French National Centre for Scientific Research (CNRS), Research Unit 7297 (TDMAM), Aix-Marseille University, Aix-en-Provence, France; Principal Investigator of the *Manuscripta Bibliae Hebraicae* Project, see website at <https://heurist.huma-num.fr/MBH>

**Research Assistant on the MBH Project, Aix-Marseille University, Aix-en-Provence, France. The 3D-experiment paper has been written within the frame of the ANR MBH Project with the help of Léo Pascal, M.A., zooarchaeologist at the LAMPEA Research Centre (MMSH). I warmly thank him for his collaboration and curiosity towards Hebrew manuscript Bibles. He conducted the shooting sessions and is the author of most of part 4.1 of this article.

¹ David Stern, “The Hebrew Bible in Europe in the Middle Ages: A Preliminary Typology,” *JSIJ* 11 (2012): 235–322; Judith Olszowy-Schlanger, “The Hebrew Bible,” in *The New Cambridge History of the Bible*, ed. R. Marsden and E. Ann Matter, vol. 2, *From 600 to 1450* (Cambridge: Cambridge University Press, 2012), 19–40; J. Kogel, “The Reconstruction of a Sefer Haftarot from the Rhine Valley: Towards a First Typology of Ashkenazi Pentateuch Manuscripts,” in *Books within Books. New Discoveries in Old Book Bindings. European Genizah Texts and Studies*, ed. A. Lehnardt and Judith Olszowy-Schlanger, vol. 2, *Studies in Jewish History and Culture* 42 (Leiden: Brill, 2014); J. Penkower, “The Ashkenazi Pentateuch Tradition as Reflected in the Erfurt Hebrew Bible Codices and Torah Scrolls,” ed. F. Bussert, S. Laubenstein, and M. Stürzebecher, vol. 3, *Zu Bild und Text im jüdisch-christlichen Kontext im Mittelalter*, Erfurter Schriften zur Jüdischen Geschichte (Erfurt: [PUBLISHER?], 2015); infra the article by Judith Schlanger and Daniel Stökl Ben Ezra published in this volume.

² Marilena Maniaci, Denis Muzerelle, and Ezzio Ornato, “Une Bible... mais encore? Le portrait des manuscrits bibliques dans la catalographie moderne,” in *Sources for the History of Medieval Books and Libraries (Fourth International Codicologendagen, University of Groningen, 8–11 October 1996)*, ed. Rita Schlusemann, Jos. M. M. Hermans, and Margriet Hoogvliet (Groningen: Egbert Forsten, 1999), 291–309.

³ See Élodie Attia, “Le projet ANR MBH, entre méthode traditionnelle et méthode quantitative,” *Carnet de recherche MBH* (blog), accessed January 25, 2021, <https://mbh.hypotheses.org/606>.

⁴ This echoes questions raised recently within Latin medieval biblical manuscript studies, see for instance Eyal Poleg and Laura Light, *Form and Function in the Late Medieval Bible*, *Library of the Written Word* 24, The

their *Sitz Im Leben*, as well as to help reassess a typology of medieval “Hebrew Bibles” by examining their different socio-cultural contexts of production.⁵ In concrete terms, the project seeks first to systematically study and describe in great detail “biblical items” included in a dedicated online database: the MBH database. The MBH descriptions aim to gather codicological, palaeographical, as well as historical and socio-contextual information, together with, insofar as this is possible, textual aspects (vocalization, accentuation, variants, textual collations, order of texts, type of biblical texts and paratexts, set of notes, illustration types) pertaining to at least one hundred manuscripts, even if the potential corpus of research items is larger. By “manuscripts” we mean here either potential codices or scrolls—whether dated or undated, complete, lacunary, or fragmentary—that have been preserved to this day and were produced up to 1300 in England, northern France, Germany, and northern Italy, using mostly Hebrew Ashkenazic script type and subtypes. Sub-corpus such as giant Bibles (“Atlantic Bibles”), small-sized Bibles (“Pocket Bibles”), or partial Bibles resulting from a process of selection can be subject to a specific qualitative study too.⁶ The aim of gathering data about all the material forms of Hebrew biblical manuscripts in circulation in Ashkenaz before 1300 affords us a better understanding of the socio-cultural meanings of these texts, their contexts of production and uses, and a more accurate definition of geographical and subregional cultural areas of the Ashkenazic World.⁷ The MBH Project intends to encourage the description of so far “little-described” items, especially undated Ashkenazic Bibles that make up the majority of the corpus. By means of future co-operations, it could sustain interoperable research between corpus of data sets concerning biblical manuscripts from antiquity to early modern times, which will eventually extend to separate tools for Hebrew sources but also biblical manuscripts written in other characters, such as Latin, Greek, Arabic.

Manuscript World 4 (Leiden: Brill, 2013); Chiara Ruzzier and Xavier Hermand, *Comment le Livre s'est fait livre: La fabrication des manuscrits bibliques (IVe–XVe siècle), bilan, résultats, perspectives de recherche. Actes du colloque international organisé à l'Université de Namur du 23 au 25 mai 2012*, *Bibliologia* 40 (Turnhout: Brepols, 2015).

⁵ See Élodie Attia, “Revue de David Stern, *The Jewish Bible: A Material History*, Seattle/Londres, University of Washington Press, coll. ‘Samuel and Althea Stroum Lectures in Jewish Studies,’ 2017,” *Études théologiques et religieuses* 94, no. 3 (November 30, 2019): 483–86; also Élodie Attia, “Bibles hébraïques partielles: le cas des 'Pentateuque-Megillot-Haftarot' ashkénazes” in *From the Thames to the Euphrates / De la Tamise à l'Euphrate*, ed. Patrick Andrist, Élodie Attia, Marilena Maniaci, *Manuscripta Biblica* (Berlin: De Gruyter, forthcoming).

⁶ See Attia, “Bibles hébraïques partielle.”

⁷ For a definition of the term “Ashkenaz” see Malachi Beit-Arié and Edna Engel, *Specimen of Mediaeval Hebrew Scripts*, vol. 3, *Ashkenazic Scripts* (Jerusalem: Israel Academy of Sciences and Humanities, 2017), Introduction; Ivan G. Marcus, “Ashkenaz,” in *The YIVO Encyclopedia of Jews in Eastern Europe*, ed. Gershon David Hundert and YIVO Institute for Jewish Research (New Haven (Connecticut): Yale University Press, 2008).

The time limit (the end of the thirteenth century) has been set as the number of Hebrew codices seems to grow exponentially after 1280. Nevertheless, a specific preliminary study of manuscripts from the first decade of the fourteenth century (dated, undated, fragmentary) is planned to discern any typological changes of structure and features of biblical manuscripts at the turn of the fourteenth century, in meaningful complementarity with the work carried out by our colleague Javier del Barco as part of the Legarad Project (CSIC Madrid).⁸

So far, our preliminary estimations of biblical Ashkenazic items produced up to (strictly) 1300 lead us to around 334 items of dated or estimated-dated codices and scrolls, in a fragmentary state or complete (See Figure 12.1).

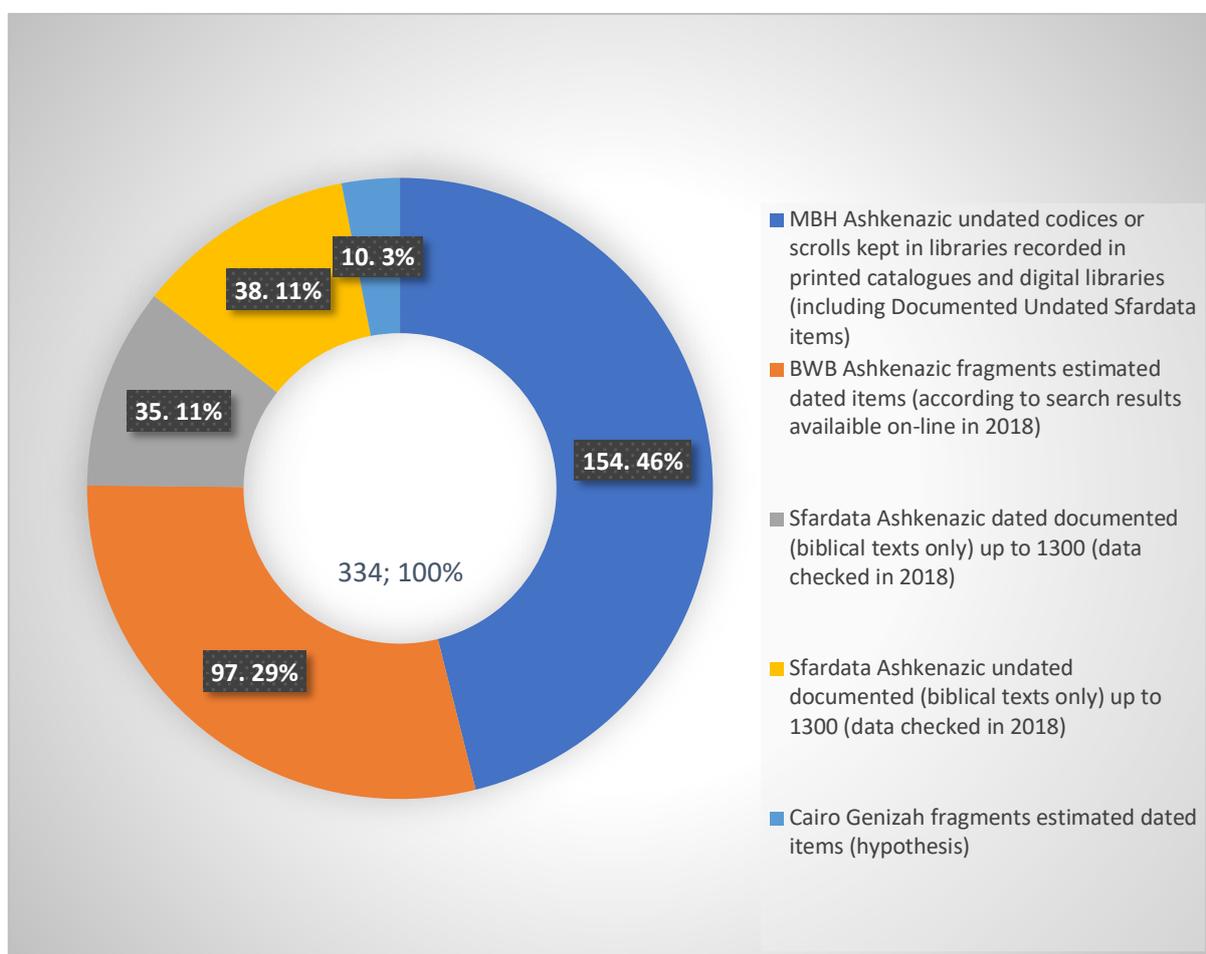


FIGURE 12.1 ESTIMATED CORPUS OF ASHKENAZIC BIBLICAL ITEMS. NUMBER OF ITEMS AND RATIO OF ASHKENAZIC BIBLICAL CODICES AND SCROLLS DATED OR ESTIMATED-DATED UP TO 1300 TO BE DESCRIBED IN THE MBH DATABASE

⁸ The Aix-Marseille Institute for Advanced Studies (IMéRA, Aix-Marseille University) hosted our colleague Javier del Barco (CSIC, Madrid) as resident from February to July 2018. I warmly thank Javier for having shared with me the “qualitative” perspectives of his LEGARAD Project on fourteenth- and fifteenth-century Sephardic Bibles, which complement so interestingly the MBH Project’s quantitative approach to early Ashkenazic Bibles.

According to the Sfardata database⁹ only 35 biblical items (Key starting with 0A-0T) produced before the fourteenth century are dated precisely, meaning that Bibles are not especially more dated than other codices.¹⁰ Concerning undated (complete) codices or scrolls that are kept in libraries, our general preliminary survey of (online or paper) catalogues allows us to estimate them, for now, to around 154 items.¹¹ To this we should add 38 undated documented items

⁹ The Sfardata database is an online tool dedicated to dated/located Hebrew manuscripts from a codicological perspective. It began in the 1960s. See Malachi Beit-Arié, “The Codicological Database of the Hebrew Palaeography Project: A Tool for Localising and Dating Hebrew Medieval Manuscripts,” in *Méthodologies informatiques et nouveaux horizons dans les recherches médiévales*, ed. Jacqueline Hamesse (Turnhout: Brepols, 1992), 17–66. See the Sfardata website at <http://sfardata.nli.org.il/>, accessed January 27, 2021, and also Malachi Beit-Arié, *Hebrew Codicology: Historical and Comparative Typology of Hebrew Medieval Codices Based on the Documentation of the Extant Dated Manuscripts Using a Quantitative Approach*, Prepublication, updated February 2020, n.d., <https://www.nli.org.il/media/4975/hebrew-codicology-continuously-updated-online-version-eng.pdf>.

¹⁰ Only 10 per cent of the Hebrew codices preserved to this day are precisely dated. Colette Sirat, *Hebrew Manuscripts of the Middle Ages*, trans. Nicholas De Lange (Cambridge: Cambridge University Press, 2002), 10–11, and the great study Colette Sirat, “Les manuscrits en caractères hébraïques, réalités d’hier et histoire d’aujourd’hui,” *Scrittura e civiltà* 10 (1986): 239–88.

¹¹ See Annexe 2. Libraries for which the consultation of printed catalogues or online descriptions has so far been taken into account: Paris, see Salomon Munk et al., *Catalogue des manuscrits hébreux et samaritains de la Bibliothèque Impériale* (Paris: Imprimerie Impériale, 1866); Javier Del Barco, *Manuscrits en caractères hébreux conservés dans les bibliothèques de France: Catalogues*, vol. 4 (Paris: BNF, Institut de Recherche et d’Histoire des Textes (CNRS); Turnhout: Brepols, 2011); and private correspondence and discussion with Del Barco during his stay at the Centre for Advanced Studies, Aix-Marseille University (IMéRA), February-July 2018. London, British Library, see J. Leveen, *Catalogue of the Hebrew and Samaritan Manuscripts in the British Museum (Now in the British Library)* (London: British Museum, 1935); <http://www.bl.uk/manuscripts/>, accessed January 27, 2021. Oxford, Bodleian Library, see Adolf Neubauer and A. E. Cowley, *Catalogue of the Hebrew Manuscripts in the Bodleian Library and in the College Libraries of Oxford, Including Mss. in Other Languages ... Written with Hebrew Characters, or Relating to the Hebrew Language or Literature; And ... Samaritan Mss.*, vol. pars 12:1–2, *Its Catalogi Codd. Mss. Bibliothecae Bodleianae* (Oxford: Clarendon Press, 1906); Malachi Beit-Arié, *Catalogue of the Hebrew Manuscripts in the Bodleian Library, Supplement of Addenda and Corrigenda to Vol. I (A. Neubauer’s Catalogue)* (Oxford: Clarendon Press, 1986). Vatican Library, see B. Richler, *Hebrew Manuscripts in the Vatican Library. Catalogue. Compiled by the Staff of the Institute of Microfilmed Hebrew Manuscripts, Jewish National and University Library, Jerusalem*, *Studi i testi* 438 (Vatican: Biblioteca Apostolica Vaticana, 2008); <http://bav.bodleian.ox.ac.uk/>, accessed January 27, 2021. Parma, Biblioteca Palatina, see B. Richler, *Hebrew Manuscripts in the Biblioteca Palatina in Parma: Catalogue* (Jerusalem: Hebrew University of Jerusalem, 2001). Berlin, Staatsbibliothek zu Berlin, see Moritz Steinschneider, *Verzeichnis der hebräischen Handschriften. Die Handschriften-Verzeichnisse der königlichen Bibliothek zu Berlin, Bd. II, 1* (Berlin: Akademie der Wissenschaften, 1878); Moritz Steinschneider, *Verzeichnis der hebräischen Handschriften. Die Handschriften-Verzeichnisse der königlichen Bibliothek zu Berlin, Bd. II, 2* (Berlin: Asher & Co, 1897). Munich, Bayerische Staatsbibliothek, see M. Steinschneider, *Die hebräischen Handschriften der K. Hof-und Staatsbibliothek in München* (Munich: Palm, 1895), accessed January 26, 2021, <http://daten.digital-sammlungen.de/~db/bsb00006297/images/>. Turin, Biblioteca Nazionale, see Bernardino Peyron, *Codices hebraici manu exarati Regiae bibliothecae quae in taurinensi Athenaeo asservatur*, ed. Biblioteca Nazionale di Torino (Turin: Fratres Bocca, 1880), accessed January 26, 2021, <http://archive.org/details/codiceshebraici00peyrgoog>; Chiara Pilocane, “I manoscritti ebraici della biblioteca nazionali di Torino,” *Materia Giudaica* IX (2004): 183–89. Bologna, Biblioteca Universitaria, see Mauro Perani and Giacomo Corazzol, “Nuovo catalogo dei manoscritti ebraici della Biblioteca Universitaria di Bologna,” in *In BUB. Ricerche e cataloghi sui fondo della Bibliotheca Universitaria di Bologna*, ed. B. Antinino and P. Moscatelli (Bologna: Minerva Edizioni, 2013), 44–50; Anne-Marie Weil-Guény, “Les manuscrits bibliques de la Bibliothèque Universitaire de Bologne,” *Hénoch* 13, no. 3 (1991): 293–95. For libraries’ digitization undertakings see <https://mbh.huma-num.fr/en/resources>. This corpus may also slightly change according to the data kindly sent by our colleague Yossi Perez who worked on Ashkenazi

(Key starting with ZA-ZT) recorded in Sfordata where a one-page questionnaire description is given; at least 97 fragments are recorded in the Books within Books (BWB) database; some Ashkenazic fragments may be identified in the Cairo Genizah.¹² The MBH Project presents an opportunity to create technical conditions in order to compare and correlate, when necessary, undated items with dated items, fragments with complete (potentially similar) Bibles, using both micro-history and macro-history perspectives.

More specifically, concerning dated codices, to the best of our knowledge, as of March 2018 the Sfordata database contains around 360 dated documented biblical text items (featuring “Biblical text only”) dating up to 1540 (which represents about 11 per cent of the dated documented items described in Sfordata),¹³ around 70 of which are Ashkenazic (i.e. about 20 per cent). Among dated Ashkenazic biblical texts recorded, 35 are dated and documented explicitly before 1300, which represents half. These 35 manuscripts are not enough to draw any conclusions on the main features of biblical Ashkenazic manuscripts before 1300 and, consequently, the study needs to be extended to at least the undated biblical items (i.e. the 154 and 38 items in Figure 12.1).¹⁴

The BWB database¹⁵ contained, in March 2018, 435 fragments of biblical codices and 44 fragments of scrolls belonging to the Middle Ages; of these, only 94 codices and 3 scroll fragments are being described as “estimated-dated” to the thirteenth century, which needs to be treated with caution.¹⁶

Pentateuchs, see J. Peretz, “The Pentateuch in Medieval Ashkenazi Manuscripts, Tikkunei Soferim and Torah Scrolls: Text, Open and Closed Sections and the Layout of the Songs” (PhD diss., Bar-Ilan University, 2008).

¹² See Annexes Tabula 1. These numbers have been obtained by us on the basis of: 1) a count of the Sfordata questionnaires (0A-0T and ZA-ZT) consulted online (March 2018); 2) discussions with Ben Outhwaite about the identification of the scripts of the fragments in the Cairo Genizah catalogue; 3) own calculations based on selective results from the BWB database’s search engines; 4) estimations based on the examination of catalogues and online images prepared by Elodie Attia, Johanna Tanja, and Léo Pascal.

¹³ 3143 items (“Doc. Dated”), Sfordata database checked December 12, 2020.

¹⁴ A number of 46 items have been derived from a direct count of the questionnaires in the Sfordata list of identified biblical texts.

¹⁵ The Books Within Books (BWB) database is an online tool dedicated to identifying and describing Hebrew fragments kept in old book bindings and preserved in European libraries. See *infra* the article by Judith Schlanger and Daniel Stökl Ben Ezra published in this volume.

¹⁶ Estimations calculated by us from the selective results appearing in the BWB database of Hebrew fragments, <http://www.hebrewmanuscript.com/>. The dating of a fragment (generally bearing no colophon) is rather uncertain, so it is still difficult to take them into count in strict statistical research.

In the Cairo Genizah Fragments collections (described by the Friedberg Genizah Project),¹⁷ even if the vast majority of the items are of Middle Eastern provenance, some of them bearing non-Oriental scripts may not have been identified properly.¹⁸

In conclusion, we estimate to circa 334 the number of biblical codices or scrolls (dated or undated, complete or fragmentary) which were produced in Ashkenaz up to 1300. Now, excluding fragments from the BWB database or Cairo Genizah, 227 items (i.e. 68 per cent) are of particular interest to the MBH Project and should be taken into account and described as a priority. The items’ distribution in libraries is shown in Figure 12.2, where three libraries hold almost half of all the items, namely those in Parma, Paris, and Oxford.¹⁹ Figure 12.2 shows the proportion of new data brought by the MBH Project, following in the footsteps of pioneer predecessors.

¹⁷ On the Friedberg Genizah Project dedicated to images and descriptions of Cairo Genizah fragments, conducted by the Association for the Study of Jewish Manuscripts and supervised by Prof. Choueka, see <https://fgp.genizah.org/>, accessed January 27, 2021.

¹⁸ Estimation based on the catalogue, see M. C. Davis and Ben Outhwaite, *Hebrew Bible Manuscripts in the Cambridge Genizah Collections*, vol. 1–4, Cambridge University Library Genizah (Cambridge: Cambridge University Library, 2003). Private correspondence with Ben Outhwaite, April 2017.

¹⁹ If we decide to include in the MBH corpus manuscripts estimated to be dating from the end of the thirteenth century or the beginning of the fourteenth century, we will also have to include manuscripts dated up to 1310 recorded in Sfardata. The amount of manuscripts will then come up to 252. These 21 manuscripts from the very end of the thirteenth century and the beginning or first half of the fourteenth century represent a sub-corpus that will need to be studied in depth.

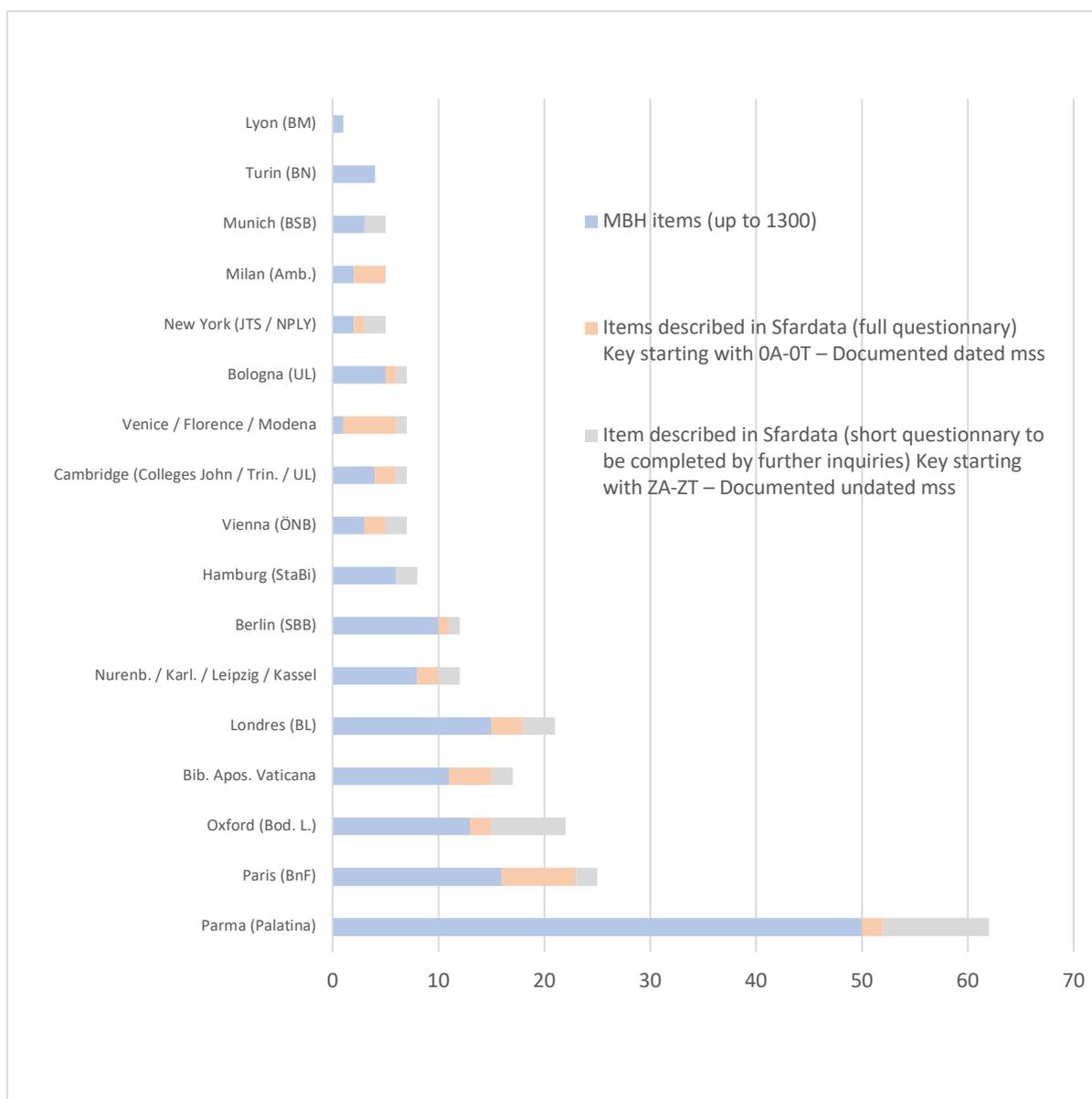


FIGURE 12.2 NUMBER OF BIBLICAL ASHKENAZIC CODICES AND SCROLLS KEPT IN LIBRARIES (FRAGMENTS EXCLUDED), INCLUDING THOSE DATED OR ESTIMATED-DATED UP TO 1300

2. Studying Manuscripts Online and the Impetus for Examining Them *In Situ*

Any systematic study of medieval biblical codices or scrolls can count now on the accessibility of a great number of online colour 2D images and online tools, and should feel encouraged by the exponential increase of efforts made by leading libraries to provide digital images of ancient books in the last decade. In this context, the new International Collection of Digital Hebrew Manuscripts KTIV (National Library of Israel) appears as a helpful tool.²⁰

²⁰ See the KTIV Portal at <http://web.nli.org.il/sites/NLIS/en/ManuScript/>, accessed March 1, 2020.

As a first step, the consultation of a 2D digitized manuscript or microfilm is always required, especially for preservation reasons and to reduce the length of time such valuable items are handled where they are stored. For studying the text, a 2D digital object is often even better than the original item because the images available are themselves made and improved to be readable (and can be then different from the original).²¹

Nevertheless, when studying materialization, it is still a requirement to seek (and fight for) data verified *in situ* by directly examining the physical manuscripts because the frequent use of 2D digitized images has only simplified the access to their contents but not really to their materiality. While gathering data for MBH descriptions of manuscripts, online examinations allow us to extract, depending on each case, only 50 to 80 per cent²² of the data required for a description, including material, structural information in addition to textual information. In practice, we must stress that other difficulties have also appeared: the number and quality of the data extracted from digitized codices or scrolls also depend on the state of preservation of the items themselves, on the kind and quality of the digitization displayed, and on the technical choices made to display the images themselves.²³ One must note here that photographic digitization protocols are definitely different for each library. As yet, there are no set “standards” and the results depend on the budget and technical choices of each library, and whether the latter is a national, regional, or municipal institution. Consequently, the “online availability” of digitized medieval manuscripts is far from being equal from one library to another, and the risk is then of collecting more data than in a traditional *in situ* scientific campaign but which are also more heterogeneous. One example and problematic aspect is the general absence of scale in images. Apart from IIF now growing, we generally deal with images without scale,²⁴ or with a scale indicated directly on the top of the manuscript page,²⁵ or a scale added at the very end of the images without any connection with the rest of the

²¹ Gold letters in some manuscripts will appear brown and not goldish at all; see for instance MS. Paris, BnF, hébreu 4 on <https://gallica.bnf.fr/>.

²² This estimation is based on the descriptions prepared within the framework of the MBH Project between September 2016 and June 2018.

²³ The images vary from black-and-white images obtained from scans of ancient microfilms to colour images obtained from a recent photo-taking campaign. These images range also from low-resolution (becoming blurred when zooming) to high-resolution (allowing viewers to zoom properly to a specific section of the image). The viewers may be different and offer different possible ways of collecting data. Some servers are very slow, making it impossible for manuscripts to be examined completely in a comfortable time period, while others are very quick to display data.

²⁴ See for instance the Northern French Miscellany (dated circa 1240–1270) with no scale but whose leaf dimensions are 160 x 120 mm.

²⁵ See images of Ms. Hamburg, StaBi, 48 (without scale) and Ms. 25–26 (with scale on the lower part of the images), Ms. 1 (with scale on the top of the images).

images,²⁶ or a scale mentioned in a picture schematically.²⁷ Last but not least, some digital libraries do not enable the correct browsing of leaves for Hebrew manuscripts from right to left, in contradiction with the natural reading of the real object.²⁸

To counterbalance the effects of a too frequent (heterogenous) use of 2D images, examinations *in situ* of each artefact would remain the best option, especially when it is undated. This also remains an imperative because one should keep in mind how paradoxical it is to build an entire search about “materialization” only from virtual objects. In some ways, materialization implies experiencing an “object that works in our hands,” in “the real life” of a past time so difficult to grasp. In order to learn from and about “materialization” we need precisely a “physical impression,” even emotions, as we sit in front of an object, something a repeated sanitized online examination cannot provide. As Colette Sirat used to say, we need to “meet” a manuscript as we would meet a person.²⁹ The archaeology of the book, then, seeks a dialogue with the object in order to learn from it and not only construct hypotheses. But while the Covid-19 pandemic is still wreaking havoc, the use of virtual codices and virtual relationships is stronger than ever, reinforcing the difficulties in grasping real codices.³⁰ In conclusion, paradoxically, in our digital age the more the objects become virtual and accessible online, the more difficult it becomes to remember them as material and real objects in a concrete context.³¹ It is why “archaeological perspectives” should be further invited into manuscript studies, and 3D images of manuscripts would be of great help.

²⁶ See Ms. Paris, BnF, hébreu 4 with one scale only on the front page, which does not belong to the main production unit in parchment. See the digitization of Ms. Parma, Palatina Library, Ms. Cod. Parm. 1872, Psalms of David with Qimhi Commentary, a very small manuscript with a scale put on a section (?) of the image in f. 147v–148r.

²⁷ For manuscripts on Gallica.fr, the BnF shows primary new information called “Taille du document” (“document size”).

²⁸ Some libraries, even some of the greatest, do not make it possible to read Hebrew manuscripts properly from right to left, which causes great slowness in the consultation and main comprehension of the book.

²⁹ Colette Sirat, *Du scribe au livre, les manuscrits hébreux au Moyen-Age* (Paris: CNRS, 1994).

³⁰ The MBH Project is not a pure digital humanities project, even if it supports the development in co-operation with Maria Gurrado (IRHT) of an online database and a software tool for describing scripts (*Graphoskop*), both to be released soon at .

³¹ I thank the colleagues met at the “Cataloguing Manuscripts” symposium (Hamburg, Centre for the Study of Manuscript Cultures, May 7–9, 2018, organized by M. Maniaci, P. Andrist, and A. Bausi) for having shared with me their impressions about this evident tendency to forget the real aspect and proportions of the books, fragments, and manuscripts that are currently consulted via online databases.

3. How Do We Learn to Read a Medieval Manuscript? Archaeological Approaches Completing Philological Approaches

In other words, the wide spread of 2D digitized images has reinforced specific ways of reading manuscripts and made it harder for codicologists to consult originals.³² Consequently, because of the (presupposed) great ease of consulting these images, the latter are now perceived—incautiously—as the “normal way” of consulting medieval manuscripts outside the concrete reality of a manuscript room in a library, which is a specific *lieu de savoir*. This effect is simple but should again be stressed: 2D images are helpful but interfere with the process of understanding those objects in their material aspects, actually reducing them to 2D flat unscaled objects that lose most of their other “dimensions” such as real scale, thickness, weight,³³ quality of the parchment and its surface, the way the ink adheres to the parchment surface (important in the case of identifying several scribes),³⁴ real colours,³⁵ smell, the sound of the folios turning (or crackling)—all material features pertaining to very old and rare objects such as a thirteenth-century medieval manuscript.³⁶

Thus, on the one hand, 2D online images foster the idea that the material aspects are less important than the artefact (the object itself) and that the main aim is still to display a written text to a vast audience. In medieval Hebrew manuscript studies we know—since the works by Colette Sirat—that material approaches to texts bring important evidence about the context in which they were produced and used, helping us to understand “archaeologically” their meaning and social and reading context.³⁷ Consequently, while experiencing this paradoxical research reality of our twenty-first century, I decided to steer the MBH project towards an experiment on 3D digitized manuscript objects, with the help of Léo Pascal. 3D images are not perceived

³² This may be related to the curators’ perception that we (academic researchers) are like “natural predators” (so to speak) in the ecosystem of medieval-book preservation, which is not of great help. I thank Matthieu Cassin, Maria Gurrado from the IRHT, and Pascal Bouhlol (AMU) for having shared with me their opinion on the growing difficulty in consulting original manuscripts in libraries.

³³ I thank here Laurent Héricher with whom I have tested and weighed some of the heaviest Hebrew Bibles kept at the BnF. According to the measurements we have carried out by weighing the manuscript in its box and subtracting the weight of the box, or by carrying the manuscript in our arms, we have evaluated Ms. Paris BnF, hébreu 4 to circa 15 kg, and Ms. Paris BnF, hébreu 33 to circa 200 g.

³⁴ I thank Anne Mailloux (LA3M, AMU) and Livio de Luca (MAP, CNRS) for sharing information with me about Reflectance Transformation Imaging (RTI). A popularizing article can be consulted on: <http://culturalheritageimaging.org/Technologies/RTI/>, accessed January 27, 2021.

³⁵ I remind here the fact that the gilding in manuscript illuminations generally shows as brown in 2D digitized images; see for instance Ms. Paris, BnF, Hébreu 4 on <https://gallica.bnf.fr/> and its 3D digitized images on the MBH Portal (MBH/BnF agreement in progress).

³⁶ I thank Peter Stokes for his enlightening discussions about this matter.

³⁷ This is perfectly well argued in the case of Latin Vulgate manuscripts by Laura Light, “Versions et révisions du texte biblique,” in *Bible de tous les temps*, ed. Pierre Riché and Guy Lobrichon, vol. 4, *Le Moyen âge et la Bible* (Paris: Beauchesne, 1984), 55–93.

here as replacements of 2D objects but as probable future necessary complements to current 2D images, especially if pandemics become more frequent due to global warming.

4. The MBH 3D Digitization Experiment: Preliminary Steps for a Virtual Online Manuscript Room

As shown for instance by our colleagues at the Centre Camille Jullian (CCJ), at the Institut de Recherche sur l'Architecture Antique (IRAA), and at the Laboratoire méditerranéen de préhistoire Europe Afrique (LAMPEA), Research Centres at the MMSH, Aix-Marseille University,³⁸ archaeologists are currently involved in using 3D visualization techniques for artefacts and archaeological objects and sites. One of the techniques currently being used is photogrammetry.³⁹ As far as manuscripts are concerned, this field is still relatively new even if potential uses have already been identified since 2012.⁴⁰ Recently, one must, in the field of the Dead Sea Scrolls, quote the interesting digitization of the En-Gedi Leviticus Scroll (dated to 300 CE) which has allowed discovering the text of a very damaged item without opening it by using a virtual unwrapping process involving 3D techniques.⁴¹ To the best of my knowledge, photogrammetry techniques are mainly used on Hebrew ancient items, such as the En-Gedi Leviticus Scroll, but are still rarely applied to Hebrew mediaeval items (either codices or scrolls or even fragments). As an example, 3D technique could be of great help for studying some of the biblical manuscripts of the National Library of Turin, especially the Ms. A I 3 which was damaged by both fire and water (see pictures).⁴² The manuscript is an Ashkenazic Bible dated

³⁸ See the January 18, 2018 and February 20, 2018 workshops of Séminaire inter-laboratoires CCJ / LAMPEA / TELEMME / IRAA, “De la Diversité des Pratiques Numériques en Archéologie et en Histoire”, MMSH, Aix-en-Provence.

³⁹ M. Kasser and Y. Egels, *Photogrammétrie numérique* (Paris: Hermès, 2001); Caroline Delevoie et al., “Un point sur la photogrammétrie,” *Archéopages. Archéologie et société* 34 (2012): 86–89, accessed January 25, 2021, <https://doi.org/10.4000/archeopages.410>; Avshalom Karasik et al., “Documentation and Analyses on the National Scale at the Israel Antiquities Authority: The Story of One (Broken) Sherd,” *Near Eastern Archaeology* 77, no. 3 (2014): 214–18; Uzy Smilansky, “The Analysis of Inscriptions and Engravings in 3D” (September 13, 2017).

⁴⁰ In France, see the first experiment made in: Pierre Cubaud, Jean-François Haas, and Alexandre Topol, “Numérisation 3D de documents par photogrammétrie,” in *Conférence Internationale Francophone sur l'Écrit et le Document (CIFED 04)*, 2004. In the USA, see Bill Endres, “Potentials for 3D in the Study of Manuscripts,” accessed December 12, 2018, <https://wrds.as.uky.edu/video/bill-endres-potentials-3d-study-manuscripts>, and projects of Alexandra Gillespie (University of Toronto, Canada).

⁴¹ William Brent Seales et al., “From Damage to Discovery via Virtual Unwrapping: Reading the Scroll from En-Gedi,” *Science Advances* 2, no. 9 (September 1, 2016): <https://doi.org/10.1126/sciadv.1601247>, accessed October 29, 2017. W.B. Seales, C.S. Parker, and P. Shor, “Virtual Unwrapping: Quantitative Distortion Analysis of Flattening Applied to the Scroll from En-Gedi” (paper presented at the 2nd International Conference on Art and Archaeology, Jerusalem, Israel, December 11–14, 2016). M. Segal et al., “An Early Leviticus Scroll from En-Gedi: Preliminary Publication”, *Textus* 26, no. 1 (2016), 29–58.

⁴² Chiara Pilocane, “I Manoscritti Ebraici Della Biblioteca Nazionale Di Torino.”, *Materia Giudaica* ix (2004), 183–189.

to 5065 (1305 CE) known through the former catalogue written in 1880 by Peyron.⁴³ This actual item, which we had the possibility to examine in 2019 in situ, has been damaged by fire and the waters of the Po river. This item is astonishingly solidified like a heavy “brick,” the folios are stiff and fixed and impossible to leaf through. No doubt these techniques could be very promising concerning this kind of valuable objects.



FIGURE 12.3 / Ms. TORINO, BIBLIOTECA NAZIONALE UNIVERSITARIA, A 13 / WITH THE PERMISSION OF THE MINISTERO DELLA CULTURA, BIBLIOTECA NAZIONALE UNIVERSITARIA DI TORINO

So far, the application of 3D techniques to medieval manuscripts has been considered of minor interest, especially if only philological interests have determined the scientific approach whereby the 2D digitization of manuscripts is supposed to be the perfect and common solution. Nevertheless, the potential of 3D digitization should be considered within an archaeological integrated approach (combining material approach and history of the texts). As Bernard Cerquigny reminds us in a short article published twenty years after his French essay, translated in *In Praise of the Variant: A Critical History of Philology* (1999):

Égarée dans la quête illusoire d’un *Ur-text*, la philologie a curieusement minoré, ignoré voire méprisé l’objet matériel qui s’offrait à son étude. Or le codex est dans tous les cas un objet coûteux, préparé avec soin, selon un plan d’ensemble et réalisé de

⁴³ Bernardino Peyron, *Codices hebraici manu exarati Regiae bibliothecae quae in taurinensi Athenaeo asservatur* (Torini: Fratres Bocca, 1880), 2–3. The manuscript had a colophon at the end noting that the scribe *sofer* Elijah b. R. Yehudah had finished the work in 5065 (1305 CE) for Menahem b. R. Aharon from Reinberg (Styria, Austria?).

façon collective; rien n’y est désinvolte. Il constitue un objet signifiant dont il nous faut réapprendre la lecture, comme il convient d’approcher sans a priori téléonomique la spécificité d’un dossier avant-textuel contemporain.⁴⁴

4.1 The Technical Process⁴⁵

The MBH 3D experiment involves photogrammetry scanning techniques, the non open-source Agisoft software, and the Autodesk Maya software. It is a low-cost non-invasive method widely used in archaeology. With this technology it is possible to digitize a single object or an entire archaeological excavation site. Photogrammetry is a particular application of stereoscopic vision, that is to say the interpretation of the disparities between several images of an object and the calculation of the depth of the scene by triangulation. It allows finding the position in space of each point on the visible surface of an object, based on the analysis of photographs taken from several different viewing angles. We use Agisoft Photoscan, a photogrammetric type of software, to digitize our manuscripts. It is a complete tool, commonly used by archaeologists, which allows us to carry out all the stages in the construction of a 3D model.

Once the object to be digitized has been shot from different angles with a digital photo camera,⁴⁶ the first stage (see Figure 12.4) is camera alignment. The software searches for common points in photographs and matches them. This allows knowing the position of the camera for each picture and creating a sparse point cloud. The next stage is generating a dense point cloud based on the estimated camera positions and the pictures themselves. The third stage is the generation of a surface. The 3D polygonal mesh model represents the object surface based on the dense or sparse point cloud. Once the surface has been reconstructed, the model can be textured.

⁴⁴ “Lost in the illusory quest for an *Ur-text*, philology has oddly underestimated, ignored, even despised the material object of its study. A codex, however, is always an expensive object, prepared with care according to an overall plan carried out collectively; there is nothing casual about it. It is a significant object which we need to relearn how to read, just as we need to approach the specificity of a contemporary set of preliminary texts without any teleonomic assumptions.” Bernard Cerquiglini, “Vingt ans après,” *Genesis* 30 (2010): 16, accessed January 25, 2021, <https://doi.org/10.4000/genesis.94>.

⁴⁵ Section 4.1 of this article has been written by Léo Pascal.

⁴⁶ We would like to thank the LA3M Research Centre for lending us the material required to take the pictures and do the calculations in Agisoft, currently used in archaeology.

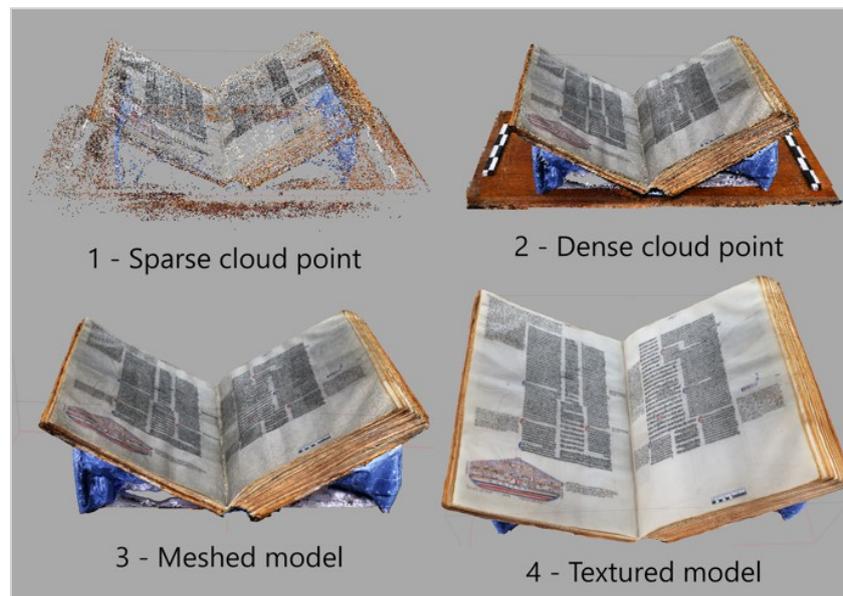


FIGURE 12.4 STEPS OF THE 3D DIGITIZATION OF A MANUSCRIPT, A GLOSSED LATIN BIBLE (ESTIMATED FOURTEENTH CENTURY) (C) MARSEILLE, BMVR, MS. 11, F. 31V-32R; IMAGES PREPARED BY LÉO PASCAL. WE ALSO THANK THE CURATOR OF THE BMVR ALCAZAR LIBRARY OF MARSEILLES, SOPHIE ASTIER.

The acquisition protocol was developed by Léo Pascal during his MA studies in archaeozoology at the LAMPEA Research Centre (MMSH, Aix-Marseille University).⁴⁷ He applied the same method as with animal bones. These 3D models are very useful in the field of comparative anatomy, which is the study of similarities and differences in the anatomy of different species. This technique makes it possible, for example, to build large reference collections of bones which can be consulted anywhere in the world. This is very convenient for field researchers as they can look up the database and determine which species a bone belongs to. At Aix-Marseille University photogrammetry has been increasingly used in terrestrial, aerial, or underwater archaeology. This method allows, for example, saving huge amounts of time in field surveys and provides highly accurate results with a precision better than 1 per 1,000, for example, 1 mm for 1m, or 1 cm for 10 m. It is important to note that the quality of the photos determines the quality of the 3D models: there must be good lighting and pictures have to be sharp.⁴⁸

In our case, in addition to making the objects accessible to a greater number of people, the point of these 3D models is to be able to compare different manuscripts in virtual rooms, to scale. Indeed, medieval manuscripts come in a wide range of forms and sizes and these 3D

⁴⁷ Léo Pascal and Pierre Magniez, “Anatomie comparée des os du carpe chez les ongulés et restitution 3D (photogrammétrie et scanner)” (Master’s Thesis supervised by Pierre Magniez (LAMPEA), Aix-Marseille University, 2016).

⁴⁸ In our case we used a Nikon camera model of medium quality to do all these tests. We are presenting here only prototypes.

displays could give us an idea of this variety. It is also an appropriate complement to 2D scans where the scale is not necessarily clearly stated.⁴⁹ 3D digitization is also interesting in terms of heritage conservation. 3D models represent a snapshot of the state of the manuscript and should be further developed especially for the study of old bindings, the history of the book, and the historical reconstruction of medieval libraries.⁵⁰

In our experience, photogrammetry is a very suitable technique for the 3D digitization of manuscripts or any other fragile object. It provides high-quality models at relatively low costs. This technique produces new virtual manuscripts that are not meant to replace 2D digitization, nor examination *in situ*. One or two views of a manuscript in 3D would be another way of completing the material approach, making it possible to apprehend its scale in a virtual room, its depth, and the general aspect of the book, in a word, “a bit of its flavour.” As for bookbinding studies, it can really become a way to restore ancient items that are also worth studying.⁵¹ Furthermore, it would allow us to create “virtual meetings” with manuscripts preserved in different places, something which, apart from exceptional exhibitions, would not be possible in real life for preservation reasons and could improve on the general audience for these kinds of research.⁵² While 2D images make philological studies possible, 3D objects, like examinations *in situ*, help remind us (albeit virtually) of the real form of a text, its “ways of working.”

4.2 Items Concerned by the 3D Experiment: Latin and Hebrew Bibles

In 2018, with the collaboration of the LA3M Research Centre, several libraries from southern France such as the *Bibliothèque Municipale Méjanes* of Aix-en-Provence, the BMVR Marseille, and the BM of Lyons were enthusiastic partners in the conduct of some tests for the 3D digitization of Hebrew and Latin biblical manuscripts. Subsequently we were also able to do some tests at the Bibliothèque Nationale de France with the help of Laurent Héricher. Again, the main point to be reminded here is that photogrammetry-based 3D digitization of codices or scrolls is not meant to replace 2D digitization but express in a different, virtual way the original object and support the call for more archaeological reconstitutions of various kinds of material

⁴⁹ See above.

⁵⁰ This would be an opportunity to work with archaeologists and medievalists from the LA3M Research Centre (MMSH).

⁵¹ See the example of 3D images of MS. Lyon, BM, Ms. 479 (hosting a Hebrew fragment in the binding) or the binding of Ms. Paris, BnF, Paris 4, <https://mbh.huma-num.fr/fr/3d-digitised-manuscripts-list/>.

⁵² Exhibitions in public libraries are, of course, one way for the wider audience to visually meet manuscripts which, incidentally, is more or less the same as using 3D images.

(fragments, codices, scrolls, but also places such as scriptoria or copyists’ workshops). The former remains a complement to the latter, especially because of some attendant technical problems: shooting an entire manuscript in 3D requires a lot of time but, most of all, since every image is a single 3D file, it would represent a very large amount of bytes.⁵³ Consequently, the MBH 3D shots are always of the book closed (namely the binding—front, back, as well as spine), from which we can reconstruct virtually the entire binding, plus one or two interesting views of the opened book.

The items we were able to shoot in 3D from December 2017 to July 2018 are listed in the table below. They will be gradually put online and integrated in the MBH portal, while waiting for a virtual room to be specially developed.

City, Library	Manuscripts	Language	Contents	Date / Estimation
Aix-en-Provence, BM Méjanes	Ms. 25	Latin	(3D Test) ⁵⁴ <i>Isidori Hispalensis libri Etimologiarum</i>	12th c.
Aix-en-Provence, BM Méjanes	Ms. 1778	Latin	(3D Test) Isidore of Sevilla's commentary on Judges and Kings	13th c.
Avignon, BM	Ms. 6872/I and II	Hebrew	Fragment of a Torah Scroll (Franco-Ashkenazic script) ⁵⁵	13th c.
Lyons, BM	Ms. 414	Latin	Latin Bible	14 th c.
Lyons, BM	Ms. 479	Latin/ Hebrew fragment	Here the interest was the medieval binding ⁵⁶	14th c.
Lyons, BM	Ms. 5	Hebrew	Part of the Hebrew Bible: Hagiographs	late 13th / early 14th c.
Lyons, BM	Ms. 3–4	Hebrew	<i>Sefer Zikhronot</i> of Elijah Levita (biblical and Masoretic concordance)	1518–1521
Marseille, BMVR Alcazar	Ms. 1	Latin	Bible	13th c.
Marseille, BMVR Alcazar	Ms. 2	Latin	Bible	late 13th c.

⁵³ At an IMéRA research seminar, MAP Director Livio de Luca underlined that a technique is emerging for quickly scanning small objects. See tweet https://twitter.com/MAP_UMR3495/status/1042714156212920320, accessed January 27, 2021.

⁵⁴ Due to the bad state of its original mediaeval binding, it has not been possible to digitize this thirteenth-century Latin Bible in 3D.

⁵⁵ I have described this fragment in the BWB database.

⁵⁶ Concerning the binding, see our 3D shot of MS. Lyon, BM, 479 where a fragment of Hebrew Talmudic codices has been found by E. Attia in 2009 and described in the BWB database. See MBH 3D digitization at <http://mbhproject.org/fr/3d-digitalized-manuscripts#o3246>.

Marseille, BMVR Alcazar	Ms. 11	Latin	Glossed Bible	14th c.
Marseille, BMVR Alcazar	Ms. 14	Latin	Glossed Bible	14th c.
Marseille, BMVR Alcazar	Ms. 1626/I Ms. 1626/II Ms. 1626/III	Hebrew	Bible in three volumes (regrouping two different <i>Production Units</i>) ⁵⁷	14th c.
Arles, Médiathèque Van Gogh	Ms. 1	Latin	A Paris Bible ⁵⁸ from the Montmajour Abbey (near Arles)	2nd half of 13th c.
Arles, Médiathèque Van Gogh	Ms. 2898	Hebrew	Fragment of a Torah Scroll (Sephardic-Provençal script) ⁵⁹	1484 at the latest
Paris, BnF	Ms. 4	Hebrew	Complete Bible (Franco-Ashkenazic script)	1286
Paris, BnF	Ms. 5–6	Hebrew	Complete Bible in two volumes (Ashkenazic script)	1295
Paris, BnF	Ms. 33	Hebrew	Complete Bible (Ashkenazic script)	13th c.
Paris, BnF	Ms. 34	Hebrew	Partial Bible (Ashkenazic script)	late 13th / early 14th c.
Paris, BnF	Ms. 53	Hebrew	Partial Bible (Ashkenazic script)	late 13th c.
Paris, BnF	Ms. 65	Hebrew	Partial Bible: Pentateuch (Ashkenazic script)	early 14th c.
Paris, BnF	Ms. 85	Hebrew	Partial Bible: Prophets (Ashkenazic script)	late 13th / early 14th c.

4.3 The Future Development of a Specific 3D Manuscript Virtual Room Project for Western Medieval Bibles

All these 3D images are available online on the MBH Project’s web portal, at first as isolated objects.⁶⁰ They do not represent a huge amount of objects but helped us to imagine a prototype of an MBH 3D manuscript virtual room as it is certain that the main point of interest in these 3D images is being able to relate one to another, in a virtual “room/place/library/scriptorium”

⁵⁷ Ms. 1626/I is a primary PU (Pentateuch, Megillot, Haftarat), written in Sephardic script. Ms. 1626/II and 1626/III are the rest of a four-volume Bible. See Gabrielle Sed-Rajna and S. Fellous, *Les manuscrits enluminés hébreux des bibliothèques de France* (Paris: Peeters, 1994). I thank Javier del Barco for sharing his expertise on this item with me in April 2018 during his stay at the IMéRA, Aix-Marseille University.

⁵⁸ I warmly thank Chiarra Ruzzier for her expertise and confirmation. I also thank Fabienne Martin, curator of the Médiathèque, Arles.

⁵⁹ I have described this fragment in the BWB database. The BWB database does not display a permalink to facilitate the quotation of the descriptions.

⁶⁰ See <http://mbhproject.org/en/3d-digitised-manuscripts-list>.

(?) on the right scale (see Figures 12.4 and 12.5 below). Consequently, the MBH Manuscript Room is one of the first prototype of its kind, a transdisciplinary virtual manuscript room for consulting, at first, Latin and Hebrew medieval biblical items that were probably circulating in the same regions at the same time.



FIGURE 12.5 SCREENSHOT OF OPEN LATIN AND HEBREW MANUSCRIPTS IN THE EXPERIMENTAL MBH VIRTUAL MANUSCRIPT ROOM FOR MEDIEVAL BIBLES. FROM LEFT TO RIGHT: AIX-EN-PROVENCE, MÉJANES, MS. 25 (12TH C., ISIDORE OF SEVILLA); LYONS, BM, MS. 414 (LATIN BIBLE OF ENGLISH PROVENANCE, CIRCA 1230, RELATED TO ROBERT GROSSETESTE ACCORDING TO SAENGER 2013, 63); ARLES, MÉDIATHÈQUE, MS. 1 (A LATIN “PARIS” BIBLE, 13TH C.); MARSEILLE, BMVR ALCAZAR, MS. 1626/I, II, AND III (A COMPOSITE SEPHARDIC HEBREW BIBLES IN THREE VOLUMES, 13TH–14TH C.); LYONS, BM, MS. 5 (HEBREW BIBLE: HAGIOGRAPHS).

Seeing and comparing Latin and Hebrew manuscripts together in the same place is not something that can occur so easily in reality, *even within the same library* during a research consultation appointment, unless this is for the purpose of an exhibition project. For instance, an authorization for Hebrew biblical manuscripts to be consulted by a Hebrew specialist will not allow the latter to order easily any kind of Latin books due to disciplinary and administrative divisions. Thus, the MBH Manuscript Room should be further developed as part of another specific project. A 3D Virtual Manuscript Room for Western Medieval Bibles combined with a database comprising material features such as, for instance, the weight and thickness of the books would show the diversity of the medieval biblical manuscripts in circulation in Western Europe and their richness from a philological as well as material and cultural point of view.



FIGURE 12.5 SCREENSHOT OF HEBREW BIBLES (SPINES) IN THE EXPERIMENTAL MBH VIRTUAL MANUSCRIPT ROOM FOR MEDIEVAL BIBLES. FROM LEFT TO RIGHT: MARSEILLE, BMVR ALCAZAR, MS. 1626/I, II, AND III; LYONS, BM, MS. 5; PARIS, BNF, MS. HÉBREU 33 (COMPLETE BIBLE, ESTIMATED-DATED 13TH C.); PARIS, BNF, MS. HÉBREU 4 (COMPLETE MONUMENTAL ASHKENAZIC BIBLE, 1286).

Conclusion

To conclude, the MBH Project, if not the first to underline the interests of 3D Visualisation applied to documents, rare books and manuscripts, was an opportunity to test preliminary technical conditions in order to compare and correlate, when necessary, undated items with dated items, fragments with complete (potentially similar) Bibles. This chance to get a general view of the material production, forms, functions, and uses of biblical manuscripts is necessary for those willing to interpret sources by using both micro-history and macro-history perspectives. As for 3D digitization, it is for the moment ignored as a tool for studying or understanding manuscripts, for both cultural and inertia reasons. In our opinion, it is not meant to replace the current 2D digitized images but represents an interesting and necessary complement to 2D scanned objects for the purpose of research that goes beyond the text and of archaeological approaches. The main effect of the extensive use of 2D digitized manuscripts is a loss of perception of the relation with the human-body scale, something that is never the case with other archaeological objects. As Cubaud - Hass - Topol remind, the traditionnal 2D approach is wellknown to be judged insufficient as far as "the Book-Object" itself is concerned"⁶¹. Paradoxically, these 3D objects-books encourage us to consider them not only as “texts” but as archaeological items that need to be placed within a “real-life” material context:

⁶¹ See Cubaud - Hass - Topol, *Numérisation 3D de documents*, Introduction.

which table or *presentoir* would they have been laid on, in which coffer or armoire would they have been kept protected, which bags would they have been carried in, on which shelf would they have been hosted in northern French houses? What was the actual economic value of these objects during their time? What functions did they fulfil? What symbolic values did they endorse through the centuries? The development of a virtual manuscript room, in parallel with a database dedicated to Bibles, would help—as the MBH experiment has shown—to construct a place where different 3D biblical items could be seen, measured, displayed, and compared on the same scale, and their context of use reconstructed (even if only hypothetically) such as in a medieval synagogue or scriptorium. The archaeological reconstruction of medieval public or private libraries should also benefit from asking where precisely giant Bibles or Torah scrolls were kept. 3D manuscript research sustains a dialogue between philology, the archaeology of the book, and socio-history; it should therefore receive more attention and could be of great help in disseminating science and allowing the wider and younger audiences to test the flavour of the Book.

Élodie ATTIA, Léo PASCAL

Acknowledgments

This work is funded by the French National Research Agency (*Projet ANR-16-ACHN-0008*). This paper is the result of an interesting collaboration between Élodie Attia, Researcher at the TDMAM (UMR 7297, Aix-Marseille University) and Léo Pascal, M.A. in Zooarcheology, Aix-Marseille University. He conducted the shooting sessions and is the author of most of part 4.1 of this article.

Bibliography

- Attia, Élodie. “Bibles hébraïques partielles: le cas des 'Pentateuque-Megillot-Haftarot' ashkénazes” In Patrick Andrist, Élodie Attia, Marilena Maniaci (editeurs), *From the Thames to the Euphrates / De la Tamise à l'Euphrate ; Intersecting Perspectives on Greek, Latin and Hebrew / Bibles Regards croisés sur les bibles grecques, latines et hébraïques*. Manuscripta Biblica 9, Berlin / Boston : De Gruyter, forthcoming 2023.
- Attia, Élodie. “Le projet ANR MBH, entre méthode traditionnelle et méthode quantitative.” *Carnet de recherche MBH* (blog). Accessed January 25, 2020. <https://mbh.hypotheses.org/606>.
- Attia, Élodie. “Revue de David Stern, *The Jewish Bible: A Material History*, Seattle/Londres, University of Washington Press, coll. ‘Samuel and Althea Stroum Lectures in Jewish Studies,’ 2017.” *Études théologiques et religieuses* 94, no. 3 (November 30, 2019): 483–86.

- Beit-Arié, Malachi. *Catalogue of the Hebrew Manuscripts in the Bodleian Library, Supplement of Addenda and Corrigenda to Vol. I (A. Neubauer's Catalogue)*. Oxford: Clarendon Press, 1986.
- Beit-Arié, Malachi. *Hebrew Codicology: Historical and Comparative Typology of Hebrew Medieval Codices Based on the Documentation of the Extant Dated Manuscripts Using a Quantitative Approach*. Hamburg University Press, Jerusalem-Hamburg, 2021, <https://doi.org/10.25592/uhhfdm.9348>.
- Beit-Arié, Malachi. “The Codicological Database of the Hebrew Palaeography Project: A Tool for Localising and Dating Hebrew Medieval Manuscripts.” In *Méthodologies informatiques et nouveaux horizons dans les recherches médiévales*, edited by Jacqueline Hamesse, 17–66. Turnhout: Brepols, 1992.
- Beit-Arié, Malachi, and Edna Engel. *Specimen of Mediaeval Hebrew Scripts. Vol. 3, Ashkenazic Scripts*. Jerusalem: Israel Academy of Sciences and Humanities, 2017.
- Cerquiglioni, Bernard. “Vingt ans après.” *Genesis* 30 (2010): 15–17. Accessed January 25, 2021. <https://doi.org/10.4000/genesis.94>.
- Cubaud, Pierre, Jean-François Haas, and Alexandre Topol. “Numérisation 3D de documents par photogrammétrie.” In *Conférence Internationale Francophone sur l'Écrit et le Document (CIFED 04)*, 2004.
- Davis, M. C., and Ben Outhwaite. *Hebrew Bible Manuscripts in the Cambridge Genizah Collections. Vol. 1–4*. Cambridge University Library Genizah. Cambridge: Cambridge University Library, 2003.
- Del Barco, Javier. *Manuscrits en caractères hébreux conservés dans les bibliothèques de France: Catalogues. Vol. 4*. Paris: BNF, Institut de Recherche et d'Histoire des Textes (CNRS); Turnhout: Brepols, 2011.
- Delevoie, Caroline, Bruno Dutailly, Pascal Mora, and Robert Vergnien. “Un point sur la photogrammétrie.” *Archéopages. Archéologie et société* 34 (2012): 86–89. Accessed January 25, 2021. <https://doi.org/10.4000/archeopages.410>.
- Easton, Roger L., and David Kelbe. “Statistical Processing of Spectral Imagery to Recover Writings from Erased or Damaged Manuscripts.” *Manuscript Cultures* 7 (2014): 35–46.
- Endres, Bill. “Potentials for 3D in the Study of Manuscripts.” Accessed December 12, 2018. <https://wr.d.as.uky.edu/video/bill-endres-potentials-3d-study-manuscripts>.
- Karasik, Avshalom, Zvi Greenhut, Joe Uziel, Nahshon Szanton, Leore Grosman, Itay Zandbank, and Uzy Smilansky. “Documentation and Analyses on the National Scale at the Israel Antiquities Authority: The Story of One (Broken) Sherd.” *Near Eastern Archaeology* 77, no. 3 (2014): 214–18.
- Kasser, Michel, and Yves Egels. *Photogrammétrie numérique*. Paris: Hermès, 2001.
- Kogel, Judith. “The Reconstruction of a Sefer Haftarot from the Rhine Valley: Towards a First Typology of Ashkenazi Pentateuch Manuscripts.” In *Books within Books. New Discoveries in Old Book Bindings. European Genizah Texts and Studies*, edited by A. Lehnardt and Judith Olszowy-Schlanger, Vol. 2. Studies in Jewish History and Culture 42. Leiden: Brill, 2014.
- Leveen, Jacob. *Catalogue of the Hebrew and Samaritain Manuscripts in the British Museum (Now in the British Library)*. London: British Museum, 1935.
- Light, Laura. “Versions et révisions du texte biblique.” In *Bible de tous les temps*, edited by Pierre Riché and Guy Lobrichon, 4, *Le Moyen âge et la Bible*: 55–93. Paris: Beauchesne, 1984.
- Maniaci, Marilena, Denis Muzerelle, and Ezzio Ornato. “Une Bible... mais encore? Le portrait des manuscrits bibliques dans la catalographie moderne.” In *Sources for the History of Medieval Books and Libraries (Fourth International Codicologendagen*,

- University of Groningen, 8–11 October 1996*), edited by Rita Schlusemann, Jos. M. M. Hermans, and Margriet Hoogvliet, 291–309. Groningen: Egbert Forsten, 1999.
- Marcus, Ivan G. “Ashkenaz.” In *The YIVO Encyclopedia of Jews in Eastern Europe*, edited by Gershon David Hundert and YIVO Institute for Jewish Research, 77–79. New Haven (Connecticut): Yale University Press, 2008.
- Munk, Salomon, Joseph Derenbourg, Hermann Zotenberg, and Adolphe Frank. *Catalogue des manuscrits hébreux et samaritains de la Bibliothèque Impériale*. Paris: Imprimerie Impériale, 1866.
- Neubauer, Adolf, and A. E. Cowley. *Catalogue of the Hebrew Manuscripts in the Bodleian Library and in the College Libraries of Oxford, Including Mss. in Other Languages ... Written with Hebrew Characters, or Relating to the Hebrew Language or Literature; And ... Samaritan Mss.* Vol. pars 12:1–2. Its Catalogi Codd. Mss. Bibliothecae Bodleianae. Oxford: Clarendon Press, 1906.
- Olszowy-Schlanger, Judith. “The Hebrew Bible.” In *The New Cambridge History of the Bible*, edited by R. Marsden and E. Ann Matter, 2, *From 600 to 1450*:19–40. Cambridge: Cambridge University Press, 2012.
- Pascal, Léo, and Pierre Magniez. “Anatomie comparée des os du carpe chez les ongulés et restitution 3D (photogrammétrie et scanner).” Master’s Thesis supervised by Pierre Magniez (LAMPEA), Aix-Marseille University, 2016.
- Penkower, Jordan. “The Ashkenazi Pentateuch Tradition as Reflected in the Erfurt Hebrew Bible Codices and Torah Scrolls.” edited by F. Bussert, S. Laubenstein, and M. Stürzebecher, Vol. 3, *Zu Bild und Text im jüdisch-christlichen Kontext im Mittelalter*. Erfurter Schriften zur Jüdischen Geschichte. Jena: Bussert & Stadeler, 2014.
- Perani, Mauro, and Giacomo Corazzol. “Nuovo catalogo dei manoscritti ebraici della Biblioteca Universitaria di Bologna.” In *In BUB. Ricerche e cataloghi sui fondo della Bibliotheca Universitaria di Bologna*, edited by B. Antinino and P. Moscatelli, 44–50. Bologna: Minerva Edizioni, 2013.
- Peretz, Josef. “The Pentateuch in Medieval Ashkenazi Manuscripts, Tikkunei Soferim and Torah Scrolls: Text, Open and Closed Sections and the Layout of the Songs.” PhD diss., Bar-Ilan University, 2008.
- Peyron, Bernardino. *Codices hebraici manu exarati Regiae bibliothecae quae in taurinensi Athenaeo asservatur*. Edited by Biblioteca Nazionale di Torino. Turin: Fratres Bocca, 1880. Accessed January 26, 2021. <http://archive.org/details/codiceshebraici00peyrgoog>.
- Pilocane, Chiara. “I manoscritti ebraici della biblioteca nazionali di Torino.” *Materia Giudaica* IX (2004): 183–89.
- Poleg, Eyal, and Laura Light. *Form and Function in the Late Medieval Bible*. Library of the Written Word 24, The Manuscript World 4. Leiden: Brill, 2013.
- Richler, Benjamin. *Hebrew Manuscripts in the Biblioteca Palatina in Parma: Catalogue*. Jerusalem: Hebrew University of Jerusalem, 2001.
- Richler, Benjamin. *Hebrew Manuscripts in the Vatican Library. Catalogue. Compiled by the Staff of the Institute of Microfilmed Hebrew Manuscripts, Jewish National and University Library, Jerusalem*. Studi i testi 438. Vatican: Biblioteca Apostolica Vaticana, 2008.
- Ruzzier, Chiara, and Xavier Hermand. *Comment le Livre s’est fait livre: La fabrication des manuscrits bibliques (IVe–XVe siècle), bilan, résultats, perspectives de recherche. Actes du colloque international organisé à l’Université de Namur du 23 au 25 mai 2012*. Bibliologia 40. Turnhout: Brepols, 2015.
- Sed-Rajna, Gabrielle, and S. Fellous. *Les manuscrits enluminés hébreux des bibliothèques de France*. Paris: Peeters, 1994

- Seales, William Brent et al., “From Damage to Discovery via Virtual Unwrapping: Reading the Scroll from En-Gedi,” *Science Advances* 2, no. 9 (September 1, 2016) <https://doi.org/10.1126/sciadv.1601247>, accessed October 29, 2017.
- Segal, Michael et al., “An Early Leviticus Scroll from En-Gedi: Preliminary Publication”, *Textus* 26, no. 1 (2016), 29–58.
- Sirat, Colette. *Du scribe au livre, les manuscrits hébreux au Moyen-Age*. Paris: CNRS, 1994.
- Sirat, Colette. *Hebrew Manuscripts of the Middle Ages*. Translated by Nicholas De Lange. Cambridge: Cambridge University Press, 2002.
- Sirat, Colette. “Les manuscrits en caractères hébraïques, réalités d’hier et histoire d’aujourd’hui.” *Scrittura e civiltà* 10 (1986): 239–88.
- Smilansky, Uzy. “The Analysis of Inscriptions and Engravings in 3D.” Presented at the ManuSciences ’17 French German Summer School, Villa Clythia, Fréjus, September 13, 2017.
- Steinschneider, Moritz. *Die hebräischen Handschriften der K. Hof-und Staatsbibliothek in München*. Munich: Palm, 1895. Accessed January 26, 2021. <http://daten.digital-sammlungen.de/~db/bsb00006297/images/>.
- Steinschneider, Moritz. *Verzeichnis der hebräischen Handschriften. Die Handschriften-Verzeichnisse der königlichen Bibliothek zu Berlin, Bd. II, 1*. Berlin: Akademie der Wissenschaft, 1878.
- Steinschneider, Moritz. *Verzeichnis der hebräischen Handschriften. Die Handschriften-Verzeichnisse der königlichen Bibliothek zu Berlin, Bd. II, 2*. Berlin: Asher & Co., 1897.
- Stern, David. “The Hebrew Bible in Europe in the Middle Ages: A Preliminary Typology.” *JSIJ* 11 (2012): 235–322.
- Weil-Guény, Anne-Marie. “Les manuscrits bibliques de la Bibliothèque Universitaire de Bologne.” *Hénoch* 13, no. 3 (1991): 293–95.

Quoted Databases:

On Hebrew Bibles and manuscripts: <http://mbh.huma-num.fr/> (in process to be transferred to <https://heurist.huma-num.fr/MBH>).

On dated or documented Hebrew manuscripts: <http://www.sfardata.nli.org.il/>

On fragments of Hebrew manuscripts (codices, scrolls): <http://www.hebrewmanuscript.com/>