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Penn, Michael, principal investigator. Digital Analysis of Syriac Handwriting. Database

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Penn, Michael, principal investigator.
Digital Analysis of Syriac Handwriting. Database.
Palo Alto, CA: Center for Interdisciplinary Digital Research at Stanford Libraries, 2019. Accessed 15 February 2020.
dash.stanford.edu.

The last two decades have seen the development of outstanding digital resources for Syriac studies, including Unicode-compatible fonts and keyboards, lexicographical tools, digitized manuscript images and metadata, and online text corpora. Among these new resources bringing Syriac studies into the digital era is the Digital Analysis of Syriac Handwriting (DASH), an online paleography project that contains the world's largest database of Syriac characters from dated manuscripts. The project began its development in 2010 under the direction of Michael Penn, professor of Religious Studies at Stanford University, in collaboration with computer scientists at Smith College and a team of collaborators from Stanford and elsewhere.

The primary purpose of DASH, according to the project's "About" page, is to explore "how recent advances in the digital analysis of handwriting can help scholars better ascertain a manuscript's provenance, identify manuscripts written by the same scribe, and trace out the chronological development of ancient scripts." The project focuses exclusively on Syriac, although the "About" page also suggests that this project may serve as a model for explorations of other ancient script traditions. From the average user's standpoint, DASH is perhaps most useful as an aid to the paleographic dating of undated manuscripts. The site allows the user to select from an enormous database of dated letterforms; the selection can then be viewed and compared with the letterforms of an undated manuscript, enabling the user to estimate the date of the latter much more precisely than existing print resources would allow.[1]

DASH's user interface is beautifully simple. The project's main feature, the Viewer, is accessible by clicking the "Get Started" button in the centre of the landing page. Then, on the left sidebar of the Viewer, one can select the

1. The main print resource is William H. P. Hatch, *An Album of Dated Syriac Manuscripts* (Boston, MA: American Academy of Arts and Sciences), 1946. This volume includes images of two hundred manuscripts, of which 119 belong to the period covered by DASH; only one plate is devoted to each manuscript. While still useful for rough estimates, this is not enough to ensure accurate comparison of letterforms. By contrast, DASH includes 154 manuscripts, each represented by multiple images.

manuscripts and the Syriac letters to be included in the query. One then clicks "Submit," and the results display in the form of a "Scriptchart" to the right of the selection pane. Each row of the chart corresponds to one letter, while each column corresponds to one manuscript, the manuscripts being automatically sorted in chronological order from left to right. Users can also click on a tab in which they can view page images of the selected manuscripts in the Mirador viewer (which was also developed by Stanford).

In the selection pane, the manuscripts can be sorted by shelfmark or by date. One can also choose whether to display the letters as "Trimmed" (converted to black pixels on white, with everything extraneous to the letter removed) or "Untrimmed" (as it appears in the original image). By hovering over (or clicking on) any letterform in the results, one can see the letter with its surrounding context. Finally, rows and columns of the Scriptchart can be hidden, allowing the researcher to narrow down the results to the ones deemed most significant. The combination of flexible queries and user-friendly interface ensures DASH's appeal to a general scholarly audience.

One feature, which may initially seem odd to Syriac scholars accustomed to the traditional division of Syriac scripts into three mutually exclusive varieties (Estrangela, Serto, and East Syriac), is that variant forms of some of the Syriac letters are included as separate characters in the selection pane and in the displayed results. For example, the letter Olaph appears in the selection pane both in the two-legged form generally characterized as "Estrangela" and in the single-stem form generally characterized as "Serto." If one selects both forms, they display separately in the results. The other letters appearing with separate variant forms are Dolath, Lomadh, Rish, and Taw. As odd as this may seem at first, it is done with very good reason, for these variant forms appear together in early manuscripts (sometimes even in the same word), and being able to view them separately allows one to easily track this co-occurrence over time. Indeed, it is the stark demonstration of this challenge to the traditional division of Syriac scripts that constitutes one of the great contributions of the DASH database, as Michael Penn and other members of the DASH team have shown in recent publications.[2]

2. See Kristina Bush, Michael Penn, R. Jordan Crouser, Nicholas Howe, and Shuangxia Wu, "Challenging the Estrangela/Serto Divide: Why the Standard Model of Syriac Scripts Just Doesn't Work," *Hugoye: Journal of Syriac Studies* 21.1 (2018): 43–80; R. Jordan Crouser, Michael Penn, and Nicholas Howe,

Above the selection pane and Scriptchart are five links to supporting pages: "About" pages that include a brief history of the project, a how-to guide, permissions for the images, and technical details; a "Contact DASH" form for comments and corrections; a page listing the participants in the project; a bibliography of publications by the DASH team and relating to DASH; and, most exciting, a page of results of research based on DASH. The latter includes parallel coordinates plots showing the chronological distribution of variant letterforms; the correlation between script and genre (biblical versus nonbiblical); and diachronic charts of column number and manuscript dimensions.

The project utilizes 154 manuscripts.[3] These are drawn from the Staatsbibliothek zu Berlin (one), the British Library (112), the Syriac Orthodox Patriarchate of Antioch in Damascus (four), the Biblioteca Medicea Laurenziana in Florence (two), the Houghton Library at Harvard University (one), the Mingana collection at the University of Birmingham (one), the National Library of Russia (two), the Bibliothèque nationale de France (five), the Pierpont Morgan Library in New York (one), Saint Catherine's Monastery in Sinai (two), St. Mark's Monastery in Jerusalem (one), the Vatican (twenty-one), and the Beinecke Library at Yale University (one). Although the project is based primarily on dated manuscripts, six of them (five from the British Library, and the one from the Mingana collection) are only approximately dated.

Some of the manuscripts are viewable in their entirety on the DASH website; for most of them, however, a selection of images from between three and eighteen page sides is used.[4] Despite some small gaps, this is certainly the largest collection of images of early dated Syriac manuscripts currently available on the Web.[5]

"Scalable Syriac Paleography Using Interactive Visualization," *Proceedings of the Workshop on Visualization for the Digital Humanities* (2018).

3. Bush et al., in "Challenging the Estrangela/Serto Divide," mention the figure of 156 manuscripts (49). Some additional, dated manuscripts, whose images are not publicly available and thus were not incorporated in the online viewer, factored into the project through secondary image sources such as published auction catalogues.

4. Entire manuscripts viewable on the DASH site include MS Syr 176 from the Houghton Library at Harvard, Sinai Syr 30, and all the manuscripts from the Vatican except Vat sir 94 (of which there are images of only two page sides).

5. Some additional early Syriac manuscripts have been digitized and are available on the website of the Hill Museum and Manuscript Library (HMML). These include HMML project numbers CPB 00464

The range of manuscripts is limited to the early period of the use of Syriac script, between the fifth and eleventh centuries CE. This excludes the surge of literary activity known as the Syriac Renaissance (twelfth to fourteenth centuries CE); it also excludes East Syriac script (whose development reaches a clearly distinctive form around the thirteenth century). This allows the database to focus on the key, and most problematic, period of development of the Syriac script.

DASH is a database for paleographic research from the ground up. It thus does not categorize script types, and it eschews technical terms. However, the database is not without theoretical assumptions. It assumes, for instance, that the most significant factor in the development of the script is diachrony. One can sort results by date, but not by other criteria such as geographical region or type of text. It would be surprising, however, if early Syriac script developed monolithically for all types of texts and without any regional variation. The place of copying is often noted along with the date in a manuscript's colophon; for example, two of the earliest dated manuscripts, BL 12150 and BL 14425, were copied in Edessa (modern Şanlıurfa) and Amid (modern Diyarbakır) respectively.[6] Including this criterion would no doubt alter the selection of manuscripts, since some manuscripts might include information on the location but not the date.[7] Also, given the fact that the monks and scholars who copied Syriac manuscripts were sometimes mobile, and the place of copying might therefore be different from the place where the scribe obtained his education, the database would have to either accept ambiguity in this regard or incorporate even greater complexity (such as including the name of the scribe as an additional criterion). While perhaps not feasible for the project at this stage, these are things that could be considered in its future development.

Altogether, DASH is a groundbreaking resource for paleographic research. It is currently one-of-a-kind in terms of the amount of data it assembles. The project has already proved its value by moving Syriac paleography to a higher

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(from the Chaldean Patriarchate of Babylon, dated 794 CE) and PLA MM 00001 (from Qarah Qush, Iraq, dated 962 CE).

6. William Wright, *Catalogue of Syriac Manuscripts in the British Museum* (London: British Museum, 1870–72), 2:633, 1:5.

7. The scribe of BL 12133, for example, is undated but notes the monastery for which the manuscript was copied. See Wright, 1:8.

level of precision. Further insights will certainly come as more scholars make use of DASH.

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Cramer, Tom, Michael A. Keller, Paola Manoni, Cesare Pasini, and Ambrogio M. Piazzoni, project leads.
Thematic Pathways on the Web: IIIF Annotations of Manuscripts from the Vatican Collections. Other.
Vatican City: Vatican Library, 2019. Accessed 26 January 2020.
spotlight.vatlib.it.

Thematic Pathways on the Web is a web platform, interface, and resource developed by a Mellon-funded, three-year collaboration between the Vatican Library (BAV – *Italian*, Biblioteca Apostolica Vatican) and Stanford University Libraries. The online resource is freely accessible and capitalizes on the immense manuscript heritage preserved in the Vatican Library's collections. At its technological core, the project relies on the sophisticated features of the International Image Interoperability Framework (IIIF), a set of open standards devised to help memory institutions share their digitized collections through a reliable framework that provides important features, such as, among others, high-resolution deep zoom and annotation capabilities. In particular, the Vatican project relies on the Mirador Image Viewer functionalities and IIIF's annotation level. This resource is innovative in its scope and use of the technology and establishes a new standard in the employment of the IIIF framework and tools for the creation of articulated resources for the perusal and study of manuscripts.

The Vatican Library's collections comprise more than eighty thousand manuscripts, of which, also thanks to the support of NTT Data, almost a fourth has, to date, already been digitized and published online on the BAV's Digital Library service using native IIIF infrastructures. The Vatican Library is, in fact, one of the founding partners of the IIIF Consortium (IIIF-C). The project aimed at pushing the boundaries of IIIF standards and technologies for the benefit of scholars of humanities in the digital age, promoting new perspectives