CHAPTER 4

Paleography: Between Erudition and Computation

In this chapter, we shall go over three topics. First, we will look at how computer-supported research has developed within paleography, finishing with a close look at automated handwriting recognition. Then, we move on to discuss the drawbacks of costly team projects, which are all too frequent with research in digital humanities. Lastly, we shall look at how we can start doing paleography within a digital workflow by using ordinary consumer electronics and applications.

1 The Variety of Digital Paleographic Experience

Since the very beginning of modern paleography, with Jean Mabillon in the 17th century, there has been a tension between objective and subjective arguments, between evidence and erudition, between emphasizing systemization or diversity. A great example of such systematized collection of evidence is Adriano Cappelli's *Lexicon Abbreviaturarum*, first published in 1899, which remains until today the standard work for looking up abbreviations and their meaning for medieval Latin manuscripts. In 1978, Bernhard Bischoff went on record saying that "Mit technischen Mitteln is die Paläographie, die eine Kunst des Sehens und der Einfühlung ist, auf dem Wege, eine Kunst des Messens zu werden."[1] Today, I would argue that paleography is perhaps the most digital field of all of manuscript studies, even though the perception within the field is at times to the contrary.[2]

1 Bischoff, B. *Paläographie Des Römischen Altertums Und Des Abendländischen Mittelalters*. Berlin: Schmidt, 1979, p. 17.

2 See Stokes, P. "Computer-Aided Palaeography, Present and Future." pp. 309–337 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009, p. 321; Stansbury, M. "The Computer and the Classification of Script." pp. 237–249 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009, p. 238; Correa, A.C. "Palaeography, Computer-Aided Palaeography and Digital Palaeography: Digital Tools Applied to the Study of Visigothic Script." pp. 247–72 in *Analysis of Ancient and Medieval Texts and Manuscripts: Digital Approaches*, edited by T. Andrews and C. Macé. Turnhout: Brepols, 2014, p. 247.

Computer-supported paleography finds expression in several ways. The main split is between those solutions which pertain to the publication phase and aim to publish or visualize something better, and those which pertain to the research phase and are meant to find data to answer a question.[3] Within the publication phase, there are roughly three different areas to be distinguished. First are those solutions that enhance conventional paper publications. Second are born-digital publications. Last, we find computer-supported innovation in education. As for the research phase, there are again three areas in which computers can enhance the work of paleographers. One is that a digital solution can be created, allowing a user to apply their traditional methodology more easily. Another is that a computer can execute the methodology itself and merely return back the final answer. Last, the digitality of digitized manuscripts and the computing power available can open up possibilities to come up with entirely new questions and new methodologies. All of these different ways of digital paleography depend on digitized manuscripts.

1.1 *From Paper to Digital*

The interaction between traditional publishing in paper form and the digital world goes both ways. Effort has gone into digitizing print materials, and techniques have been developed to digitally enhance a print publication.

For the former, a prime example is the previously mentioned lexicon by Cappelli. It was first published in 1899, after which a German edition came out in 1902, with a final edition released in 1929. There are several reprints until the digital world took hold. The original was scanned by the Google Books project and can be found twice on the net, seemingly since 2015.[4] The second German edition was scanned in Cologne and uploaded in 2012, with a copy uploaded to Archive.org in 2013. As a certain Mr. Degoix remarks on the weblog *The Ancient World Online*, the digital file is defective in several ways, mostly because it is simply missing certain pages. Another version of the second German edition, this time from 1901, was uploaded in 2015, again to Archive.org. Last, the English translation of the extensive introduction is also available online, hosted by the University of Kansas.

Remarkable it is, then, that the final edition of 1929 cannot be found. This did not deter further work on making this resource more digital in nature.

3 Hassner et al. propose a different taxonomy, cf. Hassner, T., M. Rehbein, P. Stokes, and L. Wolf, eds. "Computation and Palaeography: Potential and Limits." pp. 1–30 in *Kodikologie Und Paläographie Im Digitalen Zeitalter 3*. Norderstedt: BoD, 2015, pp. 10–12.

4 On *Calameo* which is a platform for digital magazines and on *Scribd* which is a platform for digital books. Cappelli is an ill fit for both.

A first step is a plain text version which found its way onto The-Colloseum.net. Then, the pages were indexed, and the index was made into a user-friendly interface. In fact, this was done by two different projects; one at Moscow State University, and one at Saint Louis University. Finally, we get to a fully digital database, where page numbers do not matter any longer, and ultimate flexibility is given for searching and interacting. This too has been done twice: one called *Cappelli online* (Zurich), the other *Abbreviationes* (Bochum).

The very last digital product referred to—*Abbreviationes*—has been in development since 1993 and is still undergoing maintenance. It thus outdates all the other digital products mentioned. It does not use any image from Cappelli's book as it even produces the graphical shape of the abbreviation by itself. Since it has also extended the corpus of abbreviations and their attestations, it has, in a way, grown into a thing of itself, a born-digital product. *Cappelli online* by Ad Fontes is a worthy competitor. With a much slicker interface and using small cut outs from the book to present the graphical shape of the abbreviations, it thus stays closer to Cappelli's original. Besides, *Cappelli online* is free, whereas *Abbreviationes* costs money.

Thus, with Cappelli's book as the standard reference work for abbreviations, many people in and around Latin paleography have found it irresistible to separate the entries from the page-structure and allow diverse ways of arriving at a specific entry—instead of the sole alphabetical order offered by the 1899 book—and thus make the contents of the work more accessible in the digital world and also more digital in nature. A similar path towards digital development can be traced for *Iconclass: an iconographic classification system*, which is a multi-volume classification system for art and iconography, originally done by Henry van der Waal, and also for *Die Wasserzeichenkartei Piccard im Hauptstaatsarchiv Stuttgart*, a multi-volume catalog of watermarks in ancient paper, originally done by Gerhard Piccard.[5]

Finally, paleography has also greatly benefited from digitized manuscripts in the production of facsimiles and albums of excerpts. Techniques have been developed to enhance the readability of images—for example, in cases of minor damage or bleeding through from the verso. A notebook describing both the technical process as well as an ethically responsible way of using it has been produced in the field of medieval music studies.[6] Retrieving the older text in

5 Note that this is certainly not the only online watermark database. Watermarks, illustrations, and seals have been one of the most digitized (and electronically organized) subjects and treating them comprehensively would require a chapter on its own.

6 Craig-McFeely, J., and A. Lock. *Digital Restoration Workbook*. Oxford: OSSC Publications, 2006.

a palimpsest can also be achieved by enhancing the digital photo by simply using open source software.[7]

1.2 *Born Digital, with A Hint of Print*

A plethora of websites created in the late 90's offer information about paleography (and manuscript studies more generally) in a style reminiscent of a printed publication. Notably, these pages often see a long time of steady updates and are still online as of today (June 23, 2018). A selection of such pages include Eric Voirin's *Cours de paléographie*, created in 1996 and last updated in 2014, Horst Enzensberger's *Buch- und Schriftwesen*, created in 1997 and last updated in 2013, Stephen Reimer's *Manuscript Studies: Medieval and Early Modern*, created in 1998, last updated 2015, Peter Doerling's *Sütterlinschrift lesen*, created in 1999, last updated in 2009, and Dianne Tillotson's *Medieval Writing*, created in 2000 and last updated in 2016.

The second wave of digital resources in paleography came online in the early 2000s. Examples include *Medieval Paleography on the Web*, developed between 2001 and 2005 by University of Leicester Centre for English Local History and the West Sussex Record Office. This website provides course materials for medieval and early modern English paleography. *Scottish Handwriting*, maintained between 2003 and 2015 by the National Records of Scotland, does something similar for early modern Scottish paleography. There is *Palaeographie Online*, run between 2003–2015 by a consortium of German academic institutions in Munich and Erlangen. It offers course materials for Latin paleography. From France, there is *Theleme*, launched in 2003 and still maintained by the École des chartes. This digital resource is actually a platform with various components. It has interactive facsimiles that can be used for (self-)training, proper courses, a French dictionary of abbreviations, and an extensive, systematic bibliography. A more modest website that offers a categorized list of links is the *Links für Handschriftenbearbeiter*, developed between 2003–2005 by the Kommission für Schrift- und Buchwesen des Mittelalter of the Austrian Academy of Sciences. In the same vein, we may note the creation of educational CDs and DVDs, such as by Evellum, which combined various media, including video, to deliver a self-contained, fully digital course on paleography and other aspects of manuscript studies.[8]

7 Rafiyenko, D. "Tracing: A Graphical-Digital Method for Restoring Damaged Manuscripts." pp. 121–135 in *Kodikologie und Paläographie im digitalen Zeitalter 4*, edited by H. Busch, F. Fischer, and P. Sahle. Norderstedt: BoD, 2017.

8 Muir, B.J. "Innovations in Analyzing Manuscript Images and Using Them in Digital Scholarly Publications." pp. 135–144 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009.

Compared like this, websites from the '90s and 2000s make for a stark contrast. Whereas the websites of the '90s were made by individual scholars and enthusiasts, and seem to be styled as though print publications, the websites of the 2000s are institutional and take better advantage of the possibilities digital technology offers. That is, that they do not wish to convey permanent knowledge in a page-by-page format offered for reading, but they 'do' something that requires regular updates and is given in the form of a list or is interactive. Bibliographies are an obvious genre to do this for, as the above websites testify. More specific for paleography is the rise of teaching resources. This is understandable when we look at the teaching materials available before the digital world. In the print world, instructors made a compendium of exemplary excerpts of a certain script that would allow students to see the particularities and slowly understand how to interpret a text written in that script. Creating these compendia involves a lot of work, and it is still only useful for a student if a teacher is present to point out what, exactly, is so special about each excerpt. In a digital environment, such compendia can be made quite quickly, and all kinds of extras can easily be inserted, such as circles, arrows, explanatory notes that hide/show upon a user's request, and so on. Next to that, it is easy to allow a user to study an image of a manuscript, perhaps with some tools such as a magnifier glass or the option to rotate. The user can be given the chance to type out the text in a text box, and after clicking a button, the typed text can automatically be rated against the official typescript, and the differences can be dynamically shown.[9] In short, for the kind of didactics that paleography requires, a digital environment is very suitable. Peter Stokes observes that "if digital approaches should be closely integrated with and informed by humanities scholarship; then surely it follows that teaching should reflect this."[10] It is interesting to notice how this has been taken up early on in the paleographies of different humanities subfields.

Of course, with aims set too high, an actual didactic tool might never be realized. For example, the University of London's *InScribe* never made it, the *School* section on the website of the Hill Museum and Manuscript Library shows for years now a 'coming soon' message for most of its sections, and an educational platform called *Digistylus* has been announced and described, but

9 Silke Kamp has an especially elucidating introduction on how to quickly make educational resources using simple, free software, see Kamp, S. "Handschriften Lesen Lernen Im Digitalen Zeitalter." pp. 111–122 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009.

10 Stokes, P. "Teaching Manuscripts in the Digital Age." pp. 229–245 in *Kodikologie und Paläographie im digitalen Zeitalter 2*, edited by F. Fischer, Chr. Fritze, and G. Vogeler. Norderstedt: BoD, 2010, p. 232.

not made available.[11] As we shall see more in this chapter, teams of scholars frequently dream too big, thinking that by using a digital solution anything is possible, leading to numerous empty promises.

1.3 *Traditional Work Done Better*

A different line of computer support in paleography is the digital tools that are of help during the research phase. The most basic level is easily imagined but never discussed: paleographers open JPG images of manuscripts in an image editor, cut out letters or words of interest, and paste them in a Word document or a note-taking application such as Evernote or OneNote, to group together these cutouts in a systematic fashion so that a deeper analysis can be performed. When we look at higher level computer support, we come across what is called a 'virtual research environment.' I have listed below nineteen software applications that purport to be such VREs. This list is not meant to be exhaustive. I compiled it with an eye towards their applicability to manuscript studies and further wished to give a fair impression of the development trajectory and the scope of such specialized software.

The table lists on the left the preferred name or acronym. It then indicates where the production cycle currently is. Those marked red are unavailable or unusable, and there is no prospect in sight of resuscitation. Orange means the software is currently usable, but as there is no continued development, there is a potential of it becoming unusable or unavailable. Those marked yellow indicates that the applications work wonderfully right now, but there is no concrete, visible plan on the side of the developer(s) to continue to work on it, and so there is a danger of it becoming a 'finished' product. Finally, green indicates that the app developer is clearly invested in continuing to work on it.

In the next column, I have indicated whether the underlying source code can be viewed and used ('open source'), or whether it only allows you to use the application. A striped coloring means that only an older version and/or undocumented code was made available.

The last two columns indicate, roughly, the starting date of the development and the end date. All the ongoing projects also have an end date, because, on that end date, they delivered the fully functioning application, whereas

11 Cartelli, A., and M. Palma. "Digistylus—An Online Information System for Palaeography Teaching and Research." pp. 123–134 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009. I see no substantial difference with another article: Cartelli, A. "DigiStylus: A Socio-Technical Approach to Teaching and Research in Paleography." pp. 741–753 in *Issues in Informing Science and Information Technology* 6 (2009).

TABLE 4.1 Comparison of Virtual Research Environments

Name	Status	Code	Begin date	End date
BAMBI	dead	closed	1995	1996
CEEC	out of date	closed	2001	2006
EPPT	dead	closed	2002	2005
TextGrid	slowed down	open	2006	2014
Agora	finished	closed	2006	2013
VRE-SDM	dead	closed	2007	2009
VMR CRE	slowed down	open	2008	2017
Aletheia	slowed down	closed	2008	2017
TextLab	slowed down	open	2008	2017
Teuchos	dead	closed	2009	2017
Graphoskop	finished	closed	2009	2009
SEASR	dead	closed	2010	2012
Scripto	revived	open	2010	2012
ArcheType	ongoing	open	2010	2017
Diptychon	dead	open	2011	2017
T-Pen	ongoing	open	2012	2016
Transkribus	ongoing	open	2013	2019
eCodicology	dead	closed	2013	2016
GraphManuscribble	not delivered	closed	2014	2016

'ongoing' merely means they are maintaining the application and/or developing the next version.

If we focus only on those which have slowed down or which are still ongoing, we may notice that they all do nearly the same: provide an environment to document manuscript evidence. They usually load an image, most of them then do automatic line detection, and then allow one to encode text and features and tag them to parts of the image. In most cases, it is possible to enrich the encoding with markup following the TEI standard, as explained in the next chapter. Often, the VREs offer the same or a similar interface for publishing finished transcripts, which can show the encoded texts and the image in an interactive manner. Notably, most of them can handle multiple users working on them simultaneously.

Their difference lies in the technology supporting them, the topic or purpose for which they were initially developed, and the way they are supposed to be used. Thus, TextGrid, VMR CRE, T-PEN, and Transkribus were all written mostly in Java, TextLab in Ruby on Rails, Scripto in PHP, ArcheType in Python, and Aletheia in C++.

TextGrid and *ArcheType* (formerly DigiPal) are the most versatile in intention, purposely built to support a wide array of humanities research. This may sound like a good quality, but it comes at the price of lacking certain functions that could have been of good use in your own particular project. Since they are both very big pieces of software, customizing them is not so easy. The *Virtual Manuscript Room Collaborative Research Environment* is also versatile, though specifically developed to support manuscript research in New Testament studies. Its suite of tools is seemingly as much about encoding and transcribing as it is about presenting the results. What is unique about VMR CRE is that it is entirely made up of pre-existing, open source components. Perhaps, this will make it easier to customize it and swap out one component for a better or newer one. *T-Pen* was also developed with premodern manuscripts in mind, such as the medieval 'Norman Anonymous.'[12] T-Pen has line detection and actually centers its transcription tools around the line as a unit of measure rather than a full page. *Aletheia* and *Transkribus* (formerly tranScriptorium) are geared towards automated optical character recognition, sometimes in a manuscript context called handwriting recognition (HWR). Aletheia does a particularly good job at extracting all features and characters on a page and seems to have been made with an eye towards ancient manuscripts. It can, therefore, be used very well for detailed paleographic research. Transkribus, on the other hand, shines new light on large bodies of texts from the early modern period, especially when worked on in a team or even crowdsourced. It thus draws its strength not from the attention to detail but from drawing the wider picture. *TextLab* and *Scripto*, finally, were both developed to support the diplomatic transcriptions of early modern archival materials. TextLab did so for a project on the personal archive of the novelist Herman Melville, and Scripto did so for the archive of the 18th century War Department. TextLab's project is remarkable in that Melville's papers show an incredible landscape of writing, rewriting, inserting, crossing out, and all of this on whatever piece of paper Melville could get his hands on. TextLab tries to sort out this chaos,

12 This tract is preserved in Cambridge, Corpus Christi College, MS 415, and was edited using T-Pen as the Electronic Norman Anonymous Project. Tellingly, despite the $200k grant in 2008, the digital edition can no longer be accessed.

which serves as the basis for all kinds of research, such as new insights into his writing process. Scripto's original project was perhaps even more innovative. The archive of the US War Department of the last quarter of the 18th century was lost in a fire. Copies of many of the documents can be found in all kinds of other archives, and so this project attempts to digitally bring together all these documents to reconstruct the War Department archive.

The different purpose of each VRE translates into different preferred workflows. TextGrid, T-Pen, and Transkribus require you to login and store your documents on their servers. This means you can only use them effectively when you are connected to the web. ArcheType can be downloaded and run locally, but this requires significant computer skills. All four come with a noticeable learning curve, for which some online documentation is provided. I could not test VMR CRE and TextLab, as I could not get them running.[13] They require more time to learn of the technical aspects than I was willing to invest. Similarly, I could not try all the functions of Aletheia since it is a paid software. It is a polished program with the look and feel of a Microsoft Office product. It, therefore, has only a small learning curve. Scripto, finally, is a bare-bones approach to getting a tool online quickly, capable of accommodating both basic transcriptions as well as providing a way to display transcriptions that are done. To do this, you need to have your own website running, preferably with an Omeka content management system. This is easy enough to do, even if this will be your first time doing it. With this ease, there are dangers. For example, Scripto was supported for Wordpress and Drupal too, but this relied on an external service that, at the time of writing, was not functioning. It is good, then, that Scripto secured new funding for an overhaul and update.

It is quite shocking how the majority of VREs has kept their source code closed or only shares parts of it, such as older or undocumented versions. Similarly, it is miserable to notice that half of the VREs are no longer alive and that many others are on their last legs. The basic websites from the 90s we noticed earlier in this chapter perform better than these VREs. From the funding details of a number of them, it is clear that this table represents millions and millions of Euros and Dollars. TextLab, Scripto, and T-Pen are North American projects funded in large part by the NEH. The others are European-funded, both by national agencies such as DFG and international ones such as EU's Horizon 2020 fund. From the dates, it is clear that we see the rise of big projects funded by grant agencies only in the late 2000s. I have included one outlier

13 VMR CRE came out of doctoral research by Troy Griffitts. His dissertation makes for excellent reading: Griffitts, T.A. "Software for the Collaborative Editing of the Greek New Testament." PhD dissertation, University of Birmingham, 2017.

in this regard, known as *Better Access to Manuscripts and Browsing of Images*, which existed in the 90s. It has left no trace of its existence other than a discussion in some publications,[14] but it does show that such digital approaches to manuscript studies were a long time coming.

You might wonder if you should use any of them. Two important conclusions we can draw from this brief comparison is that one size does not fit all, and that these pieces of software age quickly and badly. We can only make use of them insofar as we test that they truly help us achieve our goals, and as long as we keep in mind that they will die someday.

1.4 *Towards Handwriting Recognition*

Computer technology can sometimes provide new opportunities. One simple example is that with the switch from the print world to the digital world, scholars have developed typography that is much more extensive than was available for print, that can do much more justice to the intricate writing systems of previous centuries.

Another simple, yet brilliant, idea is the use of *Zooniverse*, a website that allows scholars to set up a project for what they call 'citizen science' but what is more commonly known as 'crowdsourcing.' The projects on *Zooniverse* are very big and attract a large group of people who volunteer their time. Paleography, and manuscripts studies in general, can also benefit from this, as has been most successfully proven by the "Scribes of the Cairo Geniza" project.[15] The general public has already classified tens of thousands of snippets coming from this medieval 'sacred trash' according to generally easy to identify characteristics such as the language of the script and whether the script is formal or informal. Not only is this form of data collection immensely innovative, but it will also get us a data set of proportions that would otherwise be impossible to achieve.[16]

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14 Bozzi, A., and S. Calabretto. "The Digital Library and Computational Philology: The BAMBI Project." pp. 269–85 in *Research and Advanced Technology for Digital Libraries*, edited by C. Peters and C. Thanos. Berlin: Springer, 1997; Calabretto, S., and A. Bozzi. "The Philological Workstation BAMBI (Better Access to Manuscripts and Browsing of Images)." *Journal of Digital Information* 1, no. 3 (1998); Babeu, A. "Rome Wasn't Digitized in a Day": Building a Cyberinfrastructure for Digital Classics. Washington: Council on Library and Information Resources, 2011, pp. 158–160.

15 Eckstein, L.N. "Of Scribes and Scripts: Citizen Science and the Cairo Geniza." pp. 208–214 in *Manuscript Studies* 3, no. 1 (2018).

16 A different from of crowdsourcing is by pulling in all available scholarly literary and automatically analyzing their contents, thereby establishing keywords for each fragment. This has been reasonably successful in the case of, again, the Cairo Geniza, see Stokoe, Chr., G. Ferrario, and M. Outhwaite. "In the Shadow of Goitein: Text Mining the Cairo Genizah." pp. 29–34 in *Manuscript Cultures* 7 (2013).

Similarly, simple yet innovative is the online tool *RetroReveal*,[17] where paleographers with no knowledge of complicated image manipulation software can upload a photo of interest and the website will return it with all kinds of different manipulations performed on it. When working with, for example, faded script, palimpsests, or seals, this can be a real boon.

A much more advanced use of computers is the attempt to find a script's characteristic shape, for example, to search through a large pile of snippets and find snippets and folia that ought to have belonged to the same manuscript.[18] There are also various ways to analyze the shape of the script to ascertain the particularity of it specific to one person, for example, by analyzing the TEI-compliant transcription of the text.[19] Another possibility is by taking measurements of certain aspects of the codex.[20] A third way is by an automated investigation of abbreviations.[21] Finally, such typologies can also be done by the raw analysis of the shapes the ink makes on the paper, what Mark Aussems calls a 'scribal fingerprint.'[22] Slightly more

17 Erickson, H.M., and J. Ogburn. "RetroReveal.Org: Semi-Automated Open-Source Algorithms and Crowdsourcing Tools for the Discovery, Characterization and Recovery of Lost or Obscured Content." p. 80 in *Archiving 2012*. Copenhagen: Society for Imaging Science & Technology, 2012.

18 Wolf, L., N. Dershowitz, L. Potikha, T. German, R. Shweka, and Y. Choueka. "Automatic Palaeographic Exploration of Genizah Manuscripts." pp. 157–179 in *Kodikologie und Paläographie im digitalen Zeitalter 2*, edited by F. Fischer, Chr. Fritze, and G. Vogeler. Norderstedt: BoD, 2010.

19 Stapel, R. "The Development of a Medieval Scribe." pp. 67–86 in *Kodikologie und Paläographie im digitalen Zeitalter 3*, edited by B. Assmann, J. Puhl, and P. Sahle. Norderstedt: BoD, 2015; McGillivray, M. "Statistical Analysis of Digital Paleographic Data: What Can It Tell Us?" pp. 47–60 in *TEXT Technology* 1 (2005); Driscoll, H. "The Legendary Legacy: Crunching 600 Years of Saga Manuscript Data." pp. 71–79 in *Kodikologie Und Paläographie Im Digitalen Zeitalter 4*, edited by H. Busch, F. Fischer, and P. Sahle. Norderstedt: BoD, 2017; Stutzmann, D. "Paléographie Statistique Pour Décrire, Identifier, Dater … Normaliser Pour Coopérer et Aller plus Loin ?" pp. 247–277 in *Kodikologie Und Paläographie Im Digitalen Zeitalter 2*, edited by F. Fischer, Chr. Fritze, and G. Vogeler. Norderstedt: BoD, 2010.

20 E.g. Brey, A., and E. Muhanna. "Quantifying the Quran." pp. 151–173 in *The Digital Humanities and Islamic & Middle East Studies*. Berlin: De Gruyter, 2016.

21 Gottfried, B., M. Wegner, M. Spano, and M. Lawo. "Abbreviations in Medieval Latin Handwriting." pp. 3–9 in *Manuscript Cultures* 7 (2013).

22 Aussems, M., and A. Brink. "Digital Palaeography." pp. 293–308 in *Kodikologie und Paläographie im digitalen Zeitalter*, edited by M. Rehbein, P. Sahle, and T. Schaßan. Norderstedt: BoD, 2009; Stokes, P. "Palaeography and Image-Processing: Some Solutions and Problems." *Digital Medievalist* 3 (2007); Herzog, R., A. Solth, and B. Neumann. "Computer-Based Stroke Extraction in Historical Manuscripts." pp. 14–24 in *Manuscript Cultures* 3 (2010); Herzog, R., A. Solth, and B. Neumann. "Computer Methods for Comparing the Hands of Manuscripts." pp. 169–175 in *Manuscript Cultures* 4 (2011).

general is an automatic assessment of the script to date and place the manuscript.[23]

The crown jewel of digital manuscript studies, automatically converting the text that manuscripts contain from a digital photo into plain text, requires a longer discussion. Such conversion would make it possible to abstract the text itself from the artifact, allowing it to be searchable. This, in turn, will allow us to automatically store the text in a file or a database, from where we can construct automatic links between different texts. One may imagine that if text recognition would be flawless, a critical edition could be made automatically by letting the computer read through the different manuscripts. After setting up rules for the computer to figure out how to combine the different versions of the text as presented in the different manuscript, the computer could turn those texts into an interactive, digital edition, or into a print edition according to a certain critical approach, including an automated generation of a critical apparatus.

However, reaching that ideal state is far from trivial. For instance, what is 'the text' referred to in my second sentence? Manuscripts rarely keep the text as a uniform body such as a printed book nearly always does. Words can be jammed in, above or below a line, as a final addition. There can be all kinds of paratexts, some of them important for a correct reading of the main text (e.g., corrections), some of them important for a correct understanding of the text (e.g., marginal comments). Even provided that the computer can accurately read all texts, it is still not obvious how all of them can be stored in a way that faithfully represents the manuscript.

Prior to this problem of faithful representation is simply the problem of optical character recognition itself. Contemporary handwriting recognition has been developed fairly well. For example, companies and governments that collect information from large groups of people by paper forms—the government's tax forms, for example—rely on the computerized reading of them. Such problems are simplified by offering only limited options, and by persuading users to write each letter in capital in a separate box. There are more advanced examples, as well. Police and intelligence agencies, for example, need to analyze vast quantities of handwritten texts for suspicious contents but also to analyze the style of handwriting—that is, to determine whether two pieces of writing are from the same hand. This kind of handwriting recognition has spawned a small industry dedicated to this problem, using

23 Christlein, V., M. Gropp, and A. Maier. "Automatic Dating of Historical Documents." pp. 151–164 in *Kodikologie und Paläographie im digitalen Zeitalter 4*, edited by H. Busch, F. Fischer, and P. Sahle. Norderstedt: BoD, 2017.

fancy terms such as neural networks and hidden markov models.[24] The visibility of this industry and its first successes have perhaps given the impression that the problem of optical character recognition has been solved. But this is not so—at least not for paleography in the true sense of the word: the study of ancient writings. Porting the solutions for today's handwritings to ancient handwritings is not straightforward, with several factors playing obvious roles. For one, today's handwriting, for most languages, is more and more letter-based instead of word-based, indicating that letters are written separately, even if they are nominally connected. Since modern OCR technology uses this to compartmentalize words into letters, the same technology cannot be applied to older and more connected scripts. A related factor is that, in the past, much more ligatures were in use. Similarly, much more abbreviations were in use, sometimes using complex notations that are easy for a hand to write and for eyes to read, but difficult to detect based on the sheer pattern of ink on paper. Another factor is that the corpus of ancient writings is much, much smaller than contemporary writings, thus making it harder to train a computer. Quite often, for the most interesting texts, there is only one manuscript witness, and its handwriting will have unique features not seen in other manuscripts. Whereas human eyes and a strong erudition can relate those features back to other scripts to figure out the meaning, computers will be at a loss to understand the blobs of ink. Furthermore, a fair few manuscripts—it seems especially those of interest—are damaged or otherwise hard to read. Whereas contemporary handwriting is often black or blue ink on pristine white paper, often with pre-printed lines to guide the sentences, manuscripts will be brownish or yellowish, with specks here and there; the ink may be faded or bleeding through the back-page, and tears, rips, and wormholes could show up in a black and white image. The script may be irregular or written at different angles. Again, whereas human eyes and erudition can separate out those imperfections from the text—often based on semantics—a computer will find it nearly impossible to decide which black spot is garbage and which black spot is valuable. On top of this, the literature on handwriting recognition hints that they use very high-resolution images, but this is simply not the reality of many of our fields, as I point out in Chapter Three.

Despite all these obstacles, steady progress is made in filtering out the script from digital photos of manuscripts. A survey of the state-of-the-art OCR technology for ancient manuscripts seems futile for three reasons. First, such a survey would have to be very long to take into account the work done on all kinds of scripts and periods. Indeed, virtually any disciplinary subfield of manuscript

24 Several academic journals specialize in it, such as Elsevier's *Pattern Recognition Letters*.

studies has seen some progress towards this goal, even if only as a proof of concept. Second, such a survey would be highly technical and, therefore, impenetrable for those who did not major in Math or Computer Science. This is because most publications on OCR technology are brief statements on the success rate of applying one or other advanced methods and do not discuss the practical implementation for humanities research purposes, but focus on the technical achievements. For lone students and scholars of humanities, this is not that interesting. Third, this industry is, at the time of writing, moving and changing fast. Thus, a survey would become quickly outdated.

That leaves us to discuss what benefits we can reap from automated handwriting recognition. Such technology often relies on 'training' a computer, so that it can build a corpus of shapes for which we manually instruct them which letters (or words) they correspond to. This is done by first typing out several thousands of words. If you have five manuscript copies of the same text, you may need to do this up to five times, if the handwriting is too different for the computer to recognize. The obvious case for which this would be a fine investment is if you are researching an archive of unique documents in the same handwriting, such as a log, chancellery books, a diary, or correspondence. In that case, the corpus is vastly larger than the amount of manual typing you need to do, and you most likely want to use text recognition mostly to find passages of interest. Additionally, those writings often have a normalized *mise-en-page*, with parts of the page always reserved for a title, a date, an amount, or a place name. Such regularities can be exploited to point the computer towards regions of interest and store the extracted information in the correct way. The case is very different for the study of premodern texts. With most texts of intellectual or cultural value, you wish to do a close reading and critical editing of the text, and for that, you will often use a variety of different manuscripts. These manuscripts are likely to have nothing in common towards the specific hand they are written in, nor is their *mise-en-page* similar (or even regular). Setting up automated text recognition might be too laborious in that case. I imagine that the first texts outside archival materials to take advantage of such technology will be scientific texts with their small vocabulary (like 'square' or 'plus') repeated over and over again, making it easy to train a computer to read such texts, and also poetry, which often has a clean and regular *mise-en-page*. For the former, the challenge to overcome is that scientific texts can be written in a sloppier hand and more crammed on a page (since the market for such texts was only tiny), making it harder for a computer to lock on and identify words. For the latter, the challenge to overcome is that poetry can have extensive and obscure vocabulary, making it harder for a computer to match the pattern with a word.

Then again, even if the premodern text is huge and you gladly train the computer in four different handwritings, it seems unlikely to me that automated text recognition is going to do much good. The manuscript world has a different concept of what a text is, as I explained in Chapter One, and this means that even the internal comparison of body-text and paratexts can easily become too atypical to be properly caught by an algorithm. Mostly, 95% of the time, a text is simply what is in the body of the folio, word for word, but it is exactly in the 5%, where something unusual is going on—an emendation in between the lines, an addition in the margin, a large omission in one manuscript—that the editor can add value by doing the analytical work for the reader and laying out the different textual elements as they ought to be.

A similar problem manifests itself on the word level. The 99% of a manuscript which is legible is not the problem; whether a person or a machine does them is merely a difference of execution time, but those 99% is hardly the value that a critical edition brings. It is the 1% which is difficult to read, where the pen of the scribe might have slipped or where a reader might have made a hyper-correction with ink just a tiny bit different from the original ink—in those cases, the erudition of an editor can weigh in to make the right decision. Meanwhile, the computer, in the words of Craig Baker, "remains incapable of distinguishing between a minor variant and a significant error, and has thus not brought with it any tangible methodological advantage in this respect."[25] Baker writes this in 2010, but as of 2019, I would still support this statement. This comes back to the problem of paleography noted at the beginning of the chapter, whether paleography is a science with hard, measurable arguments to make, or an art giving more weight to soft, erudite arguments. Even the simple paleographic task of transcription is not that easy. Do we expand abbreviations? Silently correct the gender of a verb? Use a modern way of writing a letter? Do we leave out crossed out words? Indicate rubrics? We may find that for the same question, we answer differently, judging by the context, and the purpose of our transcription. This contextualization counts even more for the letters themselves. For example, in the word 'learning,' we recognize the middle two letters as 'r' and 'n,' but in the word 'glearning' you might have mistakenly assumed there was an 'm' in the middle. In the digital world, this is more or less easy to spot,[26] but in the manuscript world, it is not easy at all and happens very frequently. The context will help you decide what the letters should

25 Baker, C. "Editing Medieval Texts." vol. 1, pp. 427–450 in *Handbook of Medieval Studies: Terms—Methods—Trends*, edited by A. Classen, 3 vols. Berlin: De Gruyter, 2010, p. 440.

26 Although, it may be noted, this exact technique is used for phishing to give the impression a message is coming from a credible source.

be. Since such decision making is at the heart of paleography, I conclude that paleography is not hard enough to be fully automatized, but not soft enough to disregard automated analysis. I think, then, that automated text recognition, when it is advanced enough to be implemented into our normal workflow, will be a great help for editors, but it remains only that—a help.

2 Rise and Fall of Team Projects Funded by Grants

I have sketched a narrative where paleography, from early on, has eagerly engaged with computer-supported solutions and, fueled by big grants, become increasingly project-centered. This has resulted in a widening gap between the lone student or scholar and those who develop electronic tools. We need to find out about the existence of such tools, then we need to get it functioning, then we need to learn how to use it, and only then can we start to do our work in it. With most scholars and even most students (despite having grown up in the digital world; born-digital, if you will) not being tech-savvy, adoption of such tools has been low. Big-grant projects that produce such tools have noticed this too, and the most common suggestion is to foster a community that rallies around a tool.[27]

On top of that high barrier to entry, we run the risk of the software malfunctioning or being entirely shut down, without the guarantee of any support. Big influx of cash for building a tool also means that there will be a point in time when there will be a huge drop in funding, quite often, in fact, it goes from all to nothing. Yet, computer technology does not age well without maintenance. In this aspect of continued usability, the making of digital tools is very different from print publications. Whereas a book is self-sufficient (you only need to know the alphabet the book is typeset in and the language it is written in), all kinds of extraneous factors—the hardware and the operating system—need to be just right for software to work. When a tool can only be used remotely over the internet, then, when the project stops paying for the server on which the application resides, the app will simply stop existing. This puts the entire product at jeopardy and, therefore, makes using it, even if the tool is currently flourishing, a lot less attractive. Will the software store and output our results in a way that will be meaningful now and in the long term? If a critical

27 As much is stated in a report entitled "SEASR—Software Environment for the Advancement of Scholarly Research", and also by TextGrid see Neuroth, H., A. Rapp, and S. Söring, eds. *TextGrid: Von Der Community—Für Die Community*. Glückstadt: Verlag Werner Hülsbusch, 2015, p. 33.

aspect breaks, who will fix it? All too often, big-grant projects do not provide documentation that answers these questions. This leads me to conclude that, from the point of view of the uncertainty of continued, paid development and maintenance, even the short-term future of software is precarious.

A hidden assumption in the previous paragraph is that the source code of the software is openly available and licensed in a way that allows free transformations (fixes and updates), leaving the option open of free (voluntary) maintenance by people outside the original team. This, however, is not as straightforward as it may sound. First, we should note that if a tool has been put together by a team, it will likely be of a complexity similar to the team structure, indicating that it is difficult for an individual outside the team to fix or amend it.[28] Second, and more importantly, a common aspect of big-grant, team-effort tools is the unwillingness (or carelessness?) of sharing the source code. This makes the software a fossil once it is abandoned by the big-grant team. As we can surmise from the discussion above, closed source software is widespread among big-grant projects, and I think it is a big reason for the unpopularity and eventual abandonment of a tool.

Not disclosing the source code is problematic for more and bigger reasons than the third-party impediment of future development. There is, I believe, an ethical component at play here. For projects that have run on public funds, it seems simply indecent to not give back to society. If we ask scholars to execute a project on behalf of the society, it should not be that only those scholars reap the benefits of it. That would not be fair to society, and it would also give an unfair advantage to the scholars who do have access to it. A similar discussion on open access publishing has been ongoing for many years, and the tide is slowly turning towards open access. In a similar vein, humanities software should become open source by default.

A result of not disclosing the code—in most cases not even discussing it—is that the software becomes a 'black box,' a 'magic device' in which anything can happen without any assurance of its veracity.[29] In more scientific terms, the experiment the code can execute cannot be replicated and, therefore, not verified. In that case, using such software fails to meet well-established academic

28 I am referring here to Conway's Law which states that "organizations which design systems […] are constrained to produce designs which are copies of the communication structures of these organizations." Conway, M.E. "How Do Committees Invent?" pp. 28–31 in *Datamation* 14, no. 5 (1968).

29 This has been noted before, see Hassner et al., "Computation and Palaeography: Potentials and Limits," p. 6; Stokes, "Computer-Aided Palaeography, Present and Future," p. 31; Solth, A., R. Herzog, and M. Neumann. "A Modular Workbench for Manuscript Analysis." pp. 132–137 in *Manuscript Cultures* 7 (2013), p. 133.

criteria. This is a particularly painful point as it is easy to suppose that the big-grant projects are well-meaning and merely want to deliver a polished user experience. The commercial world of consumer hardware and software has rapidly moved that way. Examples of hardware include Amazon's e-reader, the Kindle, and Apple's tablet, the iPad, whose inner workings are sealed off and whose tactility gives it a direct, almost thoughtless, user interaction.[30] With software it is the same—for example, the technology that makes social media applications run smoothly, such as Facebook's React which makes automatic updating in the browser possible so you can keep scrolling down infinitely and have autocorrect and autocomplete, or Twitter's Bootstrap, which makes websites render well regardless of the medium through which you are looking it up, be it a phone, tablet, or computer. The big tech companies promote this paradigm aggressively in their marketing. Big-grant developed tools follow this tone, by using declarative statements about the capacities of the software, thereby signaling that these capacities are not to be questioned, and talking in the passive voice when speaking of the development of the software as though its development has been devoid of any human decision.[31]

A corollary problem is that the more polished an application is, and the more general its purpose is stated, the less it will be suited or adaptable for a researcher's specific purpose. In the humanities, rarely can two projects be done the same way or two sources be studied and analyzed uniformly. Using a digital tool of a big-grant project requires doing your analysis less precise as—more likely than not—the tool has not been developed for your use case. This is a cost you incur that is hard to counteract.[32]

Since the end-user is now completely at the mercy of the team, this problem is aggravated when the tool demands a user to upload his or her material to the team's server. The server might be terribly slow or sometimes go offline, and if next to the raw data also notes and analysis are saved on that server, the scholar is no longer in control of their own work. Next to questions of continuity and technical compatibility, new questions concerning legality and ethics now pop up. For example: what if we paid a library for photos but the terms of the library state they can only be used for individual research purposes? Are we

30 Merkosi, J. *Burning the Page: The Ebook Revolution and the Future of Reading*. Naperville: Sourcebooks, 2013, p. xvi; Emerson, L. *Reading Writing Interfaces: From the Digital to the Bookbound*. Minneapolis: University of Minnesota Press, 2014, p. 24; McLaughlin, T. *Reading and the Body*. New York: Palgrave Macmillan, 2015, p. 179.

31 I feel it would be undeserved to cite specific people or projects.

32 Smith, N. "Digital Infrastructure and the Homer Multitext Project." pp. 121–38 in *Digital Research in the Study of Classical Antiquity*, edited by G. Bodard and S. Mahony. Farnham: Ashgate, 2010, p. 136.

allowed, in a legal sense, to upload these photos to a server of a big-grant tool? By uploading, does the big-grant team now own those photos and are they allowed to do other things to it? What if the library, the user, and the server are in different countries? Do different laws apply? What if the work of a scholar on such a server-hosted tool is deleted without notice? Has the scholar some rights to get their work back or appeal the decision? So far, scholars (and students) in the humanities have operated on good faith when it comes to these legal issues. That has worked well in as much as scholars mostly worked on their own computers, but once a server-hosted tool is involved, the user will be exposed to much more imminent legal issues. Next to this are ethical concerns. If the archival material contains private data, such as personal details that would not be incorporated in the final analysis, it may not be alright to leave that on a server you do not control yourself. In short, server-hosted tools needlessly complicate our workflow, exposing us to significant liabilities.

So far, we have discussed the drawbacks of such tools. Let us now focus more on the team-aspect inherent to developing a complicated tool at once. The very notion of 'team' in the sense of working together towards one product is quite foreign to many humanities disciplines. The norm is lone scholars working on a project by themselves from start to finish, resulting in a publication with only one author (themselves). Of course, throughout the project, ideas and drafts are bounced off of colleagues. Conferences and teaching duties are other parts of a scholar's normal life in which they can contribute to projects of others and receive contributions, mostly through criticism and pointing out relevant primary sources and secondary literature. But throughout this process it remains the work of the one scholar, and as a result we rarely encounter multi-authored publications. Even in digital humanities, when it is time to publish, single-authored papers are the norm.[33]

For big-grant tools, the building of a tool has virtually always been proposed as a joint effort by humanities scholars, who think of what the tool should do, and engineers who think of how technology can do that.[34] Some scholars boldly state that "high level interdisciplinary collaboration between humanist research and computer science was *demanded*" (emphasis added).[35] Sometimes,

33 Nyhan, J. "Joint and Multi-Authored Publication Patterns in the Digital Humanities." pp. 387–399 in *Literary and Linguistic Computing* 29, no. 3 (2014).

34 Bradley, J. "No Job for Techies: Technical Contributions to Research in the Digital Humanities." pp. 11–25 in *Collaborative Research in the Digital Humanities*, edited by M. Deegan and W. McCarty. London: Routledge, 2012.

35 Busch, H., and S. Chandna. "ECodicology: The Computer and the Mediaeval Library." pp. 3–23 in *Kodikologie Und Paläographie Im Digitalen Zeitalter 4*, edited by H. Busch, F. Fischer, and P. Sahle. Norderstedt: BoD, 2017, p. 6.

teams claim this has worked remarkably well.[36] But the majority of cases run into difficulties. The joint statement of a seminar on digital paleography in Leibniz is brutally honest. Their number one finding is that "difficulties in communication between palaeographers and computer scientists is a prevailing problem."[37] It is worth quoting in full a later statement:[38]

> It might seem at first that problems in communication are easy to solve, and that it is "just" a matter of listening and understanding, a matter of ironing out differences. However, even in our group of twenty people at Dagstuhl from different backgrounds, where all were accustomed to collaborative scholarship, a striking recurring difficulty in understanding each other was apparent.

Two points are made that are especially interesting to us. First, even at a high-level meeting such as this one, where members of both parties were experienced in the topic at hand and motivated to discuss it with the other, communication broke down. Second, they emphasize that they were all accustomed to working with colleagues, and so the problem cannot be a lack of social skills, but it must be sought in their difference of expertise or education towards that expertise. Peter Stokes echoes this sentiment, pointing out that it is all fair and well to say that a humanities scholar is not expected to understand "the intricacies of postgraduate-level mathematics," but this does mean that "if we cannot understand them then we cannot evaluate them properly or debate their results."[39]

2.1 *Archetypes across the DH Spectrum*

As a solution, the people from Leipzig suggest that a new breed of academics is necessary: "a middle-person, a translator: a person who is versed enough in each of the collaborating fields to understand enough of each of the discipline-specific lexical fields to foster good communication and fruitful exchanges."[40] Stokes, on the other hand, sees more success in "a 'lone scholar' working on all aspects of the topic, theoretical and practical, 'digital' and 'humanities.'"[41] Of course, these solutions do not have to exclude each other. Such a lone, well-

36 See e.g. Muir, who says "I feel that it is what has given us the edge over our colleagues during the past decade." p. 137.

37 Hassner et al., "Computation and Palaeography: Potentials and Limits," p. 2.

38 Ibid., p. 13.

39 Stokes, "Computer-Aided Palaeography," p. 322.

40 Hassner et al., "Computation and Palaeography: Potentials and Limits", p. 16.

41 Stokes, "Computer-Aided Palaeography," p. 326.

versed scholar would be an excellent candidate as a middle-person. More importantly, we do not have to think of it as a binary choice with now a third option in the middle. Computer-supported research does not need to be seen as 'digital humanities', cut off from 'classical humanities.' Instead, I think, we are better off if we place such research on a DH spectrum. To get a better grip on such a spectrum, I propose to introduce six archetypes in which the vast majority of humanities scholars and students can be categorized.

The Believer. On the utmost right side of the spectrum, we find *the believer*, somebody who is fully absorbed in the digital humanities. They have made it their field in which they want to make a career. Hence, their research is mostly geared towards developing and applying new technologies, pushing the boundaries of what is possible. They have advanced and intimate knowledge of programming and the way technology works, since their study or personal development time is maximally spent on it. They see no great problem in the perceived chasm between 'classical humanities' and 'digital humanities' and would likely not agree that the team-based, big-grant projects are a failure.

The Obstinate Ostrich. On the other side of the spectrum we find *the obstinate ostrich*. This archetype accommodates a diverse group of people in the humanities who ignore computer technology not out of ignorance but as a choice and so they too are perfectly happy with seeing 'digital humanities' as something entirely different from 'classical humanities.' Essentially, they won't go beyond using the computer as a typewriter. As a consequence, they feel it is unfair that what they can accomplish by great labor, some people now accomplish with a simple search through a database. If we try to grab their attention we run the risk of being repaid with a very negative response. Since this archetype is discernible among people in influential positions, this is not to be overlooked. They can and will shut down "this DH nonsense" if we are not careful.

The Sour One. Going back to the right side of the spectrum, just left of *the believer*, we find *the sour one*. They did not want to showcase their technological progress only to people in DH, but they wanted to have it accepted by their peers. They have, by all accounts, already tried to be that middle man, but for a complication of reasons, this has so far fallen on deaf ears. There is a danger for people using tech in the humanities to become this archetype. Perhaps a way to avoid it is to choose carefully who you engage with; both *believers* and *ostriches* are not ideal conversation partners if the initiative for collaboration did not come from them.

The Spider. Not too far off from *the sour one*, we can find *the spider*. They are usually professors at the helm of a research team that is doing exciting stuff with technology in the humanities. As a team effort, their tech level falls at the mid to high level of the spectrum, but *the spider* him- or herself usually only

has passive knowledge of the possibilities and limitations of technology. Their added value lies primarily in having a large network and the ability to attract grants. Through their grants they can employ people who *are* capable of wiring together tech and humanities research. Their main job, then, is to connect people. In strengthening the entire spectrum of DH, and making computer technology a normal part of humanities research, they are very important.

The Blind and the Lame. Here we have a symbiosis between a professor who is enthusiastic about digital solutions, and a student or hired professional who can get the technology to work. Often times, the professor, relying on their expertise, will come up with research questions that are closer to classical humanities than research questions a *believer* or *spider* would come up with. The professor sits on top of the shoulders of the student, instructing them to go this or that direction. I think actually that this archetype is not very helpful. It would be better if we can redirect the enthusiasm of the professor by for example giving the student more opportunities to open their eyes and learn to walk by themselves.

The Centaur. It is very likely that you, as a reader of this book, are a *centaur*. *Centaurs* are students and scholars who are simply working in the humanities but are devoting real time to learn how to use computers in a serious way. Some spend more time on this than others, but for all counts that their head is firmly rooted in conventual methods and practices of their field, while their feet are taking on distinctly digital shapes. As long as they do not let their heads also turn digital, which would turn them in *believers*, this group has the greatest potential to fill that spectrum and decisively shift the practices of the humanities towards the digital world in which, to be honest, we already live. Because *centaurs* obtain an active skillset in using computers in their workflow, and because they do so in the context of their own study or research, they are self-sufficient and do not require other people or grants to implement their computer skills.

3 Drawing Ancient Symbols on a Tablet

After getting to know these very expensive projects that produced complicated software, and if you are ready to be a centaur, let us start with something simple yet effective. Mastering a basic skill, such as recreating symbols of paleographic interest on a computer, will be a major boon to manipulate and analyze them easier. In this section, we will discuss how to do that. As with most chapters in this book, our discussion will be shaped by a case study, to get a better sense of how it can be of practical benefit. The case study was done with

an expensive tablet and a stylus, as the haptic interaction provides a uniquely fine experience to do this kind of work. I am assuming you already have such a device for general consumer needs. I use an iPad Pro from 2017 (model A1701), but what I explain here is device-independent and can be done on an older or a newer tablet. Moreover, much of the procedure described here can be done on a normal computer too, with a mouse.

We will learn to use a function that will remain a feature of all vector-based drawing applications, namely the pen tool. I use the app Vectornator, and on my computer I use Adobe Illustrator. The latter is a commercial, paid software. You may obtain it through your university or look for a free alternative, such as InkScape, which can run on Windows, macOS, and Linux. For a drawing application to be vector-based means that everything you draw is not stored as color values for pixels, but as mathematical points, lines, and shapes. This means that you can zoom in all you want but nothing will look pixelated because the curve of the lines and shapes will be recalculated and redrawn. With the pen tool, you can add points (often called anchor or corner points) on a drawing area (usually called canvas) to make a line. And if you make the last point coincide with the first, it will recognize the entire line as a shape (often called a path). What is especially attractive about the pen tool is that, at each point, you will have two levers or handles on each side of the point relative to the line it is a part of. And by selecting and dragging these levers, you can adjust the curve the line makes on that side of the point. Lastly, the pen tool helps separate the different tasks of drawing a line and/or shape and giving that line and/or shape an appearance: first, you draw the contours, and only then do you select a particular line and fill the style—for example, whether you want an outline or not and whether that outline should be dashed or solid, whether the shape should have a gradient fill and where that gradient should start and end, and so on.

Thus, using the pen tool is as simple as first adding points that roughly outline the shape you want to draw, then adjusting the curvature of all the segments of the outline to perfectly match the shape you want, and finally to give the shape the colorful appearance you want. Shapes with holes in them can also be drawn by drawing the holes first and giving them a different color, then the outer shape, selecting all, and using the function to 'combine paths' (the icons should guide you to the right choice). It is called 'Path' in Vectornator and 'Pathfinder' in Illustrator.

To understand the intricacies, we will walk through a project from start to finish: namely, a better understanding of three symbols a medieval Islamic philosopher wrote which, he says, represent the essence of his teachings.[42]

42 I published my findings before and parts of that article are reproduced here: Lit, L.W.C. van. "Mysterious Symbols in Islamic Philosophy." pp. 34–39 in *Islamic World of Art* 3 (2017).

To find symbols in a philosophical text is surprising. Manuscript copies of Islamic philosophical texts consist of walls of text, page after page. Readers of Islamic philosophy were not interested in embellishments or illustrations. Neither were writers; only very seldom did they make use of graphics or symbols to get their point across. Suhrawardī (d. 1191) is such an exception. Even though this philosopher only lived to be 36 years old, he produced an extraordinary philosophical output in which he advanced a great number of innovations. He himself was wont to describe these innovations in terms of an entirely new system of thought, which he dressed up in a vocabulary which used terms such as luminosity and light. Accordingly, his *magnum opus* is called *Ḥikmat al-ishrāq*, 'The philosophy of illumination.' In a text he wrote later, *al-Mashāriʿ wa-l-Muṭāraḥāt*, 'The paths and havens,' the previously-mentioned symbols appear in the introduction. The passage can be translated as follows:

> When the student has fully grasped this way of thinking,[43] then let him commence with scintillating practices according to the judgment of the Custodian of Illumination, until he himself may see some of the principles of illumination so that the foundations of the matters become resolved for him. As for the three before-mentioned forms in 'The philosophy of illumination,' they are ***XYZ***. Understanding them is only granted after illumination.[44]

I used ***X***, ***Y***, and ***Z***, as placeholders for these symbols. The whole passage finds an equivalent in *Ḥikmat al-ishrāq*, which I will cite here too, to make the passage more understandable:

> I exhort you to preserve this book, to keep it safe and guard it from those unworthy of it. […] Give it only to whoever has fully grasped the method of the Peripatetics, a lover of the light of God. After commencing, let him practice for forty days, abstaining from meat, taking little food, concentrating upon the contemplation of the light of God, most mighty

43 Suhrawardī sets up a difference between the philosophy of everybody else and his own. The former is considered Peripatetic and discursive, his own is illuminative and intuitive. For Suhrawardī they are not competing but different stages; one first needs to master Peripatetic philosophy before illuminative philosophy can be practiced. Cf. Suhrawardī, *The Philosophy of Illumination* [= Ḥikmat al-ishrāq], Translated by J. Walbridge and H. Ziai, Provo: Brigham Young University Press, 1999, pp. 3, 170 fn. 12.

44 Suhrawardī, *al-Mashāriʿ*, in *Opera Metaphysica et Mystica* [= Oeuvres Philosophiques et Mystiques / Majmūʿa fī l-ḥikma al-ilāhiyya], Edited by H. Corbin, 4 vols., Orig. publ. 1945–1970., Tehran: Institut franco-iranien, 2009, vol. 1, pp. 194–195.

> and glorious, and according to what the Custodian of the Book commands him.[45]

These passages describe certain instructions for Suhrawardī's students about the circulation of his book *Ḥikmat al-ishrāq*. This book is not to be handed out until a person is already an advanced student of philosophy, with knowledge of books by, for example, Aristotle and Ibn Sīnā. Then begins a forty day trial period of asceticism and meditation. The final decision regarding the admission of a candidate to the next round is ultimately in the hands of a 'custodian' (*qayyim*); a term seemingly implying Suhrawardī nominated an heir to lead a group of initiated followers. In this context, Suhrawardī shares three symbols that are supposed to convey a key message about *Ḥikmat al-ishrāq*, and the knowledge of the symbols is only granted to the initiated.

In total, I collected digital versions of seven manuscripts and one printed edition of *al-Mashāriʿ wa-l-Muṭāraḥāt*, so that we may compare the symbols in different manuscripts. This step was done quite conventionally; by first collecting references to different manuscripts from the introduction to the edition and from other scholarly articles, and then setting out to acquire digital copies of them one by one. As a second step, I reduced this material to a folder with one image file per document, giving each image the name of the origin. From a quick comparison of these images, looking at them in rapid succession, it became clear that the symbols were cause of confusion among those copying the text. Two manuscripts did not have them at all: in Ayasofya 2571, the text simply continues without the symbols, as though nothing was supposed to be there. In the case of Milli 32785, an empty space is left where the symbols ought to have been. These omissions prove that the copyists deemed the symbols as something extraordinary from the text, something to be added later. Consider also the placement of symbols in other manuscripts: in Ayasofya 2570 and Topkapi 3377, the text runs equally continuous as in Ayasofya 2571, and the symbols are drawn in the margin. In Leiden Or 365, they are also in the margin, with a *ṣaḥḥ* ('correct') to indicate it should be considered part of the text. Even though they should be considered part of the text, their placement in the margin signifies a paratextual quality. This is even true when the symbols are in the text block. In Laleli 2552, they span no less than four lines and function like an inline graphic or illustration. Only in Arabca Yazma A 4302 are the symbols truly inline. However, when we look at the size and color, we see signs that even in Arabca Yazma's manuscript the symbols are given a special place,

45 Suhrawardī, *The Philosophy of Illumination*, p. 162. Translation adapted.

as they are written similar to the chapter headings, being slightly bigger and in red. In fact, in all but Leiden's manuscript, the symbols are drawn in the ink of the rubrics (red for most but gold for the Topkapi one).

To analyze the six versions of the symbols I had, I loaded the relevant images onto my iPad. I then opened the application Vectornator and opted to begin a new drawing. Once a blank canvas was loaded, I inserted one of the images by clicking on the flower-like symbol in the menu on the top right. Once loaded, I locked the layer with the photo, so that I could not accidentally move or change it. Already having the photo like this was a vast improvement over looking at it on my computer, as I could zoom and rotate to my heart's content.

From here, the idea is fairly simple: trace the symbols from the photo using the pen tool to get the vector shapes of the symbols. This provides several benefits. First, by making vector shapes out of the symbols, you get a sharper version of the symbols, for which it is easier to see what exactly they are supposed to depict. In fact, I found that the very exercise of redrawing the symbols forces you to consider carefully what exactly the shape of the symbol is. For example, since the symbols are written fairly small in a few manuscripts, and since ink leaves a certain thickness on the paper, if the scribe makes two strokes very close to each other, the ink of both strokes might muddy. Given a photo with only so-so quality will exacerbate this effect. By zooming in and retracing the symbol, you might find that there are in fact two strokes, and to indicate this, you will likely make the gap between the strokes slightly bigger than is visible in the photo. Second, once you have vector shapes, you can freely enlarge them, move them around, rotate, mirror or distort them otherwise; you can try to make a bigger shape by composing them or try to make smaller shapes by deconstructing them. Since you can copy and paste the original vector shape over and over again, you can try out many different things with relative ease. The ability to give them different shape colors and turn the borders on/off is extremely useful, especially when deconstructing the shapes or overlaying different versions of the shapes.

To do the tracing, I follow several conventions. First, already at the drawing stage, I do some deconstruction by drawing the symbols into meaningful, small shapes. This is better, since it is very easy to combine different shapes into one or simply give them the same color to give the appearance of one uninterrupted shape, but it is more laborious to break shapes up. Second, I draw every shape on a separate layer and keep all layers for one symbol together. To distinguish between different manuscripts, I keep the photo layer and the symbol layers grouped together. Third, I try to draw the shapes as sleek as possible, since it is easier to expand them and have them retain the correct shape than it is to shrink them and maintain their shape.

Drawing a set of three symbols took me about twenty to twenty-five minutes. To do this for five manuscripts and a printed edition is, then, a non-negligible investment of time, but it can easily be done after office hours as it is a fairly relaxing exercise. I exported the results to SVG and loaded this into the Illustrator to prepare the illustrations below, which I saved as PDFs.[46] The first illustration gives an impression of the different versions of the symbols.

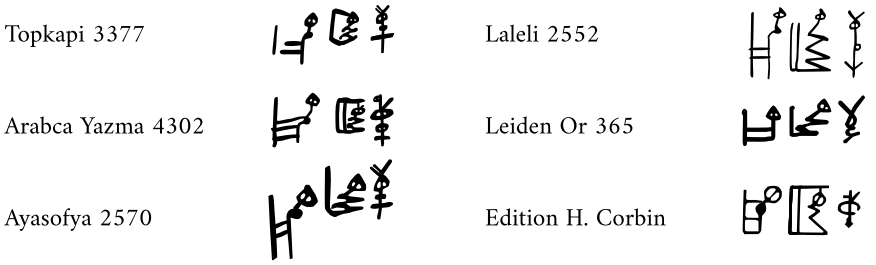

FIGURE 4.1 Suhrawardī's symbols redrawn from five manuscripts and an edition

What is instantly clear is that the shape of the symbols is not uniformly agreed upon, meaning we are faced with a double-layered puzzle. We need to find out the original shape of the symbols, and we want to figure out what those shapes could mean. Further, by comparing Corbin's version with the manuscript versions, we can recognize what Corbin did when he prepared his edition. The symbols in Corbin's edition are clearly based on Arabca Yazma's manuscript (or a manuscript associated with it) and go beyond it by idealizing the shapes. Corbin apparently saw them as geometric shapes and, therefore, emphasized this in his rendering, only making use of straight lines, squares, and circles.

We can break them down one by one. The following illustration gives the six versions of the left symbol with each element that is in common in the same color. The two letters underneath are an abbreviation for the source from which they came.

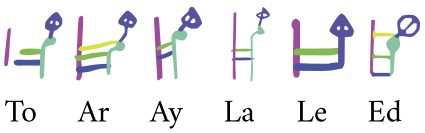

FIGURE 4.2 Deconstruction of the left symbol

46 SVG stands for Scalable Vector Graphic. This image format is much used in web technology.

What is now apparent is that the symbol is seemingly made up of Arabic letters. On the left is an *alif*, common to all versions. Then there are two horizontal strokes like a *ba*. A third stroke is only present in the versions of Arabca Yazma and Corbin. A *mim*-shaped stroke appears on the right, although Leiden's manuscript apparently does not have it. On top, common to all, is a *ha*. The greatest common factor can be found in the manuscripts of Topkapi, Ayasofya, and Laleli. It may be immediately noted that those three versions are still quite different. Topkapi's left symbol has its *alif* detached, while Ayasofya is thick and slanted to the left, and Laleli is thin and long.

But the middle symbol shows a different story when we look into it.

FIGURE 4.3
Deconstruction of the middle symbol

For this symbol, Topkapi, Ayasofya, and Laleli are not similar at all, while the manuscripts from Ayasofya and Leiden are almost identical. An *alif* shape (in orange), is common to all, and so are the two *ḥa* shapes and a *ha*. A *ba* shape on top is only visible in Topkapi, Arabca Yazma, and the edition. A second *alif* is only present in Arabca Yazma, Laleli, and the edition. Then, there is the strange case that Arabca Yazma has an additional v-shape at the top, maybe like an *ʿālamat al-ihmāl*, a sign to indicate an unpointed letter. Laleli has an additional *ḥa*-shape. The greatest common version of the symbol is, then, presented in Ayasofya and Leiden, with Ayasofya's version looking the most like the others.

For the symbol on the right, we have the following comparison:

FIGURE 4.4
Deconstruction of the right symbol

For this one, Leiden's manuscript simply has something entirely different; a *lam*, *alif*, and *hamza* or *ʿayn*. Equally, Corbin's edition made a bit of a mess of this symbol. In fact, only using the other symbols was I able to discern the different elements and the correct shape of Corbin's version, and thus we may still identify several elements with elements from other versions. A central element is a *ha*, which is followed downwards by a *mim*. In Arabca Yazma, this *mim* looks more like another *ha* with a long tail, and in Corbin's edition it is merely a stroke with an additional blob at the bottom. A *ba* (in red) is common to many,

though Laleli's one has an angle, almost like the v-shape we saw before. Such a v-shape, in fact, is present in all of them at the top. Something else is going on there too, about which there is little agreement. Topkapi's and Ayasofya's manuscript suggest an additional stroke, while in Arabca Yazma there seems to be a tiny *ha* of some sorts, which translates into Corbin's edition as a horizontal dash. It may again be noted that Ayasofya's manuscript has the most common depiction of the symbol.

Using this interpretative angle, I wish to single out the versions of Ayasofya and Leiden as particularly representative. Given that they show the most stable elements in their symbols, could it be that they show the symbols in their most correct form? If this is so for the left and middle symbol, how did Leiden get such a different symbol for the right one? I will leave these two questions open, but I will elaborate on the main question: what do the symbols mean? According to our work, they are constructed out of Arabic letters, and perhaps this is a factor for their meaning.[47]

If we follow Ayasofya's symbols, the sequence of Arabic letters would be the following: *ha*, *mīm*, *ba*-shape, *ba*-shape, *alif* - *ha*, *ḥa*-shape, *ḥa*-shape, *alif* - *v*-shape, *ha*, *mīm*, *ba*-shape. With "-shape," I mean that this letter is ambiguous since the base shape is shared by different letters. With one dot underneath the *ba*-shape, it is in fact a *ba*, but with one dot above it is a *nūn*, with two dots above it is a *ta*, with two dots underneath it is a *ya*, and with three dots above it becomes a *tha*. A *ḥa*-shape can also be a *kha* and *jīm*. If we follow Leiden's manuscript, the last symbol consists of *alif*, *lām*, *hamza* or *ʿayn*.

The use of letters to construct a symbol may be significant for an anagram or if they are used for their numerical value. If it were an anagram, I can only read أخوة باب الحماه in it: 'The brothers of the gate of Hama.' But as I indicate, this would suppose one more letter, the *waw*, and it would require the use of the Leiden version for the symbol on the right, whereas our analysis seems to suggest Ayasofya to be a better representative. Hama is a city in Syria, about 120 km south of Aleppo and about 45 km north of Homs. I do not know what its significance might be, other than a name for the initiated group of followers which Suhrawardī alludes to in his *al-Mashāriʿ* and *Ḥikmat al-ishrāq*. For numerical values using the Abjad system, and relating this to numerology, the options are too diverse, the results too speculative to make any formal

47 There are other leads still open, too. Given Suhrawardī's interest in astrology and the occult, his symbols may have derived from that literature. Additionally, the style is reminiscent of cryptographic alphabets such as analyzed in Monteil, V. "La Cryptographie Chez Les Maures." pp. 1257–1264 in *Bulletin de l'Institut Français d'Afrique Noire* 13, no. 4 (1951).

statement. The bottom line is, however, that by changing specific characters of paleographic interest into vector shapes, we can find out more about them in an easier and visually more obvious manner. Once converted to SVG, it is easy to include them in an online publication, such as an edition or catalog. To do so, however, requires a lot more understanding of how text and graphics work together in the digital world. This will be the topic of the next chapter.