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The Computer and the Classification of Script

Mark Stansbury

Abstract

In the 1970s Bernhard Bischoff famously predicted that, thanks to technology, palaeography was on the road to becoming an art of measurement. The journey down this road has not been smooth, however, for several reasons. Although the idea of measurement seems uncontroversial, E.A. Lowe's attempt to measure the number of manuscripts written in half-uncial script shows that the script names that lie at the heart of palaeographical descriptions pose an insuperable problem, whether to man or machine. The reasons for this unsatisfactory system lie in the historical development of the discipline from its invention in the late-17th century. From the first, the names of scripts were used to localise manuscripts in time and place, and the names palaeographers use today are the direct descendants of these early systems. In the mid-20th century palaeographers began to focus on a different way of looking at script by exploring the strokes used to create the letters (*ductus*). These two approaches have led to a discipline divided between Linnaeans who emphasize taxonomy and Darwinians who emphasize evolution. Most digital palaeography has focused on the first, while the second could offer a richer vein to mine.

Zusammenfassung

Bereits in den 1970er Jahren sagte Bernhard Bischoff voraus, dass wegen der technologischen Entwicklung die Paläographie auf dem Wege sei, eine Kunst des Messens zu werden. Der Weg dorthin verläuft jedoch aus unterschiedlichen Gründen nicht geradlinig. Obwohl die Idee des Messens unproblematisch erscheint, zeigt E.A. Lowes' Versuch die Zahl der Handschriften in Halbunzial-Schrift zu »messen«, vor welchem Problem Mensch und Maschine stehen: Es sind die »Schriftnamen«, die als Grundlage der paläographischen Beschreibung dienen. Der Grund hierfür ist aus der Entwicklung der Disziplin seit ihrer Einführung im späten 17. Jahrhundert zu erklären. Von Beginn an wurden Schriftnamen benutzt, um Manuskripte in Raum und Zeit zu lokalisieren, und die Bezeichnungen, die Paläographen heute benutzen, sind direkte Abkömmlinge dieser frühen Bemühungen. Seit Mitte des 20. Jahrhunderts begannen Paläographen, Schrift auf eine andere Art zu betrachten, indem sie die Strichführung (Duktus) zur Erzeugung von Buchstaben untersuchten. Diese beiden Ansätze haben zu einer Disziplin geführt, die sich aufspaltet zwischen den Linnéisten, die die Taxonomie betonen, und

den Darwinisten, die die Evolution hervorheben. Digitale Paläographie hat sich bislang zumeist auf den ersten Ansatz konzentriert, während der zweite eine fruchtbarere Ader bietet, die es zu erschließen gilt.

1 Introduction

In a much discussed passage in the introduction to his *Paläographie des römischen Altertums und des abendländischen Mittelalters*, Bernhard Bischoff wrote that thanks to technical means palaeography was on the way from being an art of seeing and aesthetic empathy (*Kunst des Sehens und der Einfühlung*) to becoming an art of measurement (*Kunst des Messens*) (Bischoff 2004 19). In the thirty years since he wrote those words, the technical means to accomplish the measurement he predicted have certainly grown prodigiously, primarily in two areas: first, the production of images through digital photography and their reproduction and distribution through the World Wide Web; and second, the analysis of those images by computer. Yet much evidence suggests that palaeography generally has not moved far down the road Bischoff predicted for it in 1978. For example, of the general introductions to the field written after Bischoff—Gasparri, Derolez, and Frenz updating Foerster—only Derolez even acknowledges the existence of the road that Bischoff saw. And far from sharing Bischoff's vision, Derolez called his choice of words 'regretful' and foresaw a limited role for quantitative data in palaeography (7-8). Even for those who see themselves travelling toward the same goal, that of making palaeography a *Kunst des Messens* using technology, there are many roads that seem to lead there, as the contents of this volume shows. Although palaeography was born of technological developments, trying to incorporate recent technology seems to have encouraged a fundamental re-examination of the aims of palaeography. This paper aims to ask why that re-examination is necessary and to suggest a few ways forward.

2 Measuring and Manuscripts

To begin with, Bischoff's statement has a vaguely oracular quality that may partially explain the amount of scholarly discussion it has stimulated. Though the discussions have focused on Bischoff's view of the future, his view of palaeography in his day is almost as interesting as his prediction for the future. By choosing to describe palaeography as an art of seeing and of *Einfühlung*, Bischoff was echoing a phrase of Joachim Kirchner's (Derolez 2 n. 3) and associating palaeography with aesthetic theories of the late-19th and early-20th century. The German *Einfühlung* is a calque of the Greek ἐμπάθεια and was first used in connection with aesthetics in 1873 by Robert Vischer in his

Über das optische Formgefühl: Ein Beitrag zur Aesthetik (Koss 139), with the earliest citation of English ‘empathy’ in this sense published in 1904 according to the *Oxford English Dictionary*. The principle Vischer proposed is that viewing inanimate forms involves the unconscious projection of the viewer’s own bodily form onto the viewed object so that the experience of the object becomes in some sense corporeal, hence the possibility of empathy with inanimate forms (Koss 140). Bischoff’s choice of words is thus more resonant than the translations ‘seeing and understanding’ (Bischoff 1990 3) or ‘seeing and comprehending’ (Derolez 2). Rather than basing the palaeography of his day on these relatively vague terms, Bischoff chose to found it on a late-nineteenth century aesthetic understanding of non-corporeal forms through the activity of seeing. But for Bischoff palaeography was and remained an art. German *Kunst* has much the same semantic range as English ‘art’ and by it Bischoff must have meant a set of techniques roughly corresponding to the late-antique and medieval *ars*, as opposed to the systematic body of knowledge implied by *Wissenschaft*. Most significant, however, is the radical simplification his statement predicted for the future: through technology, no longer would palaeographers look at letterforms and use aesthetic empathy to understand them; instead, they would measure. And of course *Messen* has caused most discussion because it changes the role of the palaeographer and because it offers a central place to the technical means that seemed to be around the corner—all the while remaining vague about what those technical means were. Whatever they were, however, they no longer required that palaeographers look and try to achieve an empathetic understanding of forms.

Given the state of computer analysis when Bischoff wrote, as well as the lack of interest his own work shows for it, this prediction seems to be more an educated guess about the relatively bleak future than a specific vision of it. The statement remains significant, however, because of the use others have made of it, for Bischoff’s *Kunst des Messens* has come to represent the future of palaeography. One reason for this is that his term ‘measurement’ involves the recording of results obtained by observation (as opposed to seeing). When we measure the length of an object we observe where its edges fall in relationship to the marks on a ruler, for example. It is possible to perform this action with more or less accuracy, but once there is agreement about what is to be measured, the process is straightforward. Such observation can be replaced by technical devices: instead of comparing the edge of an object with the marks on a ruler, the display of a digital caliper can simply produce the result. Technical devices can substitute for observation in this sense because they can collect the data they are designed to collect, but they cannot see in the same way that humans can and they certainly cannot experience the kind of aesthetic empathy that Bischoff saw as central to palaeography.

Whatever exact future Bischoff predicted, any art of measuring must consist in establishing magnitudes that can then be compared. The most elementary form of such a method applied to manuscripts consists in measuring and looking for patterns. We

may, for example, measure the dimensions of manuscript pages, the dimensions of their writing areas, and the number and position of the ruling lines and then record the results in a database. We can then ask whether the manuscripts in the database fall into categories, whether a given manuscript is related in format to any of the manuscripts in the database, whether that relationship is significant, etc. The scholars in *Mise en page et mise en texte du livre manuscrit* (Martin and Vezin) have shown that this process can lead to interesting results, to take just one group of examples. Most palaeographers would consider such work to be codicological rather than palaeographical, however, since it deals not so much with script as with the supports for script. Still, similar quantitative methods have been applied to script, such as the study of Bozzolo and Ornato on ligatures cited with approval by Derolez (8). Similar approaches, Derolez argued, ought to be confined to ones that count and measure ‘significant features of handwriting’ and chart the results (8–9). In other words, Derolez argued for looking for significant features, measuring them, then analyzing the results. Even this, however, is easier said than done and the reasons for this difficulty point to one of the great roadblocks on the way to the palaeography of the future.

In order to demonstrate the problem, we can take E. A. Lowe’s ‘Hand-List of Half-Uncial Manuscripts’, first published in the *Miscellanea Fr. Ehrle* in 1924. This project would seem to be exactly the sort of thing Derolez advised: Lowe examined manuscripts, ‘measured’ the ones in half-uncial script, and then gave the results in a list of 160 manuscripts. In even so elementary a task, however, there are difficulties, and Lowe meets them in characteristically cantankerous fashion. He is not interested, he writes, in futile discussions about whether half-uncial is a minuscule or a mixed script. ‘The name “half-uncial” stands for a definite type and calls up a clear and distinct image’ (Lowe 35). Yet in the next paragraph, the image turns out not to be so clear and distinct as one might hope, for in this paragraph Lowe laid out his rule for distinguishing half-uncial from uncial and minuscule. It would be easy if every scribe were like the scribe of the Basilican Hilary, he writes, but alas it is not so. Lowe called scripts like that of the Hilary manuscript ‘canonical half-uncial’, by which he means that the letterforms of these manuscripts closely match a single, idealized half-uncial alphabet, which is the rule (canon) that they obey. Unfortunately, such manuscripts represented only a portion of his corpus: ‘[...] there are many deviations from this norm, chiefly owing to the presence of uncial elements.’ What’s a palaeographer to do? Lowe, rarely at a loss, devised a rule: any script was half-uncial if it had four non-uncial letterforms, giving the examples of the letters **b**, **d**, **m**, **g**, **r**, **s**. Yet even then not everything fell into place: ‘On the other hand, there are some eighth-century manuscripts, which show a curious mixture of uncial and half-uncial forms, which renders classification rather arbitrary’ (Lowe 36). So not even the arbitrary rule designed to clarify an already clear image kept Lowe from using his judgment in the basic job of counting which manuscripts are written in half-uncial script. Ironically, then, Lowe’s contortions serve to point out that

'half-uncial calls up a clear and distinct image' cannot be true. If this is so, what are we to make of claims that the name is 'useful and scientific'? What would happen, for example, if we changed Lowe's rule to three variant letterforms? It would not change the image of the script, but it would change the number of manuscripts in the list.

The purpose of this example is to show that statistical operations can be used in certain cases, i.e. those in which the classification of the things being enumerated is clear. Unfortunately, as palaeographers we often find ourselves in Lowe's position—discussing not how many half-uncial manuscripts there are but how to define a half-uncial manuscript. In other words, even if a machine existed that could automatically analyze scripts and match them to the idealized alphabets of the handbooks, thus classifying manuscripts automatically, it still could not solve the problem Lowe faced and that the palaeographers who followed him have, for the most part, avoided. In order to understand one way that technology can play a role in palaeography, then, we must first examine the naming of scripts.

3 Historical View of Script Classification

Technology and palaeography were intimately connected long before Bischoff wrote, of course. Indeed, palaeography was made possible by two technological innovations in the fifteenth century: printing and engraving. Engraving and later etching and lithography made possible the mass reproduction of identical facsimiles of scripts. These reproductions could then be compared with manuscripts and with each other, a comparison that would previously have required drawings or a good visual memory. Printing, then, made possible the mass reproduction of the analyses of the plates produced by engraving. It was one of Ludwig Traube's many insights that the history of palaeography continued to be linked with the techniques of reproduction, characterizing the discipline in his day as palaeography in the age of photography (Traube 57). It is thus an homage to Traube's work that we speak of palaeography as being in a digital age. The implications of this fact are that reproductions are more complete and more easily available than at any time in history.

As is well known, the first systematic classification of scripts grew out of the disagreement between the Maurist Jean Mabillon and the Bollandist Daniel Papebroch. In answering Papebroch's *Propylaeum antiquarium circa veri et falsi discrimen in vetustis membranis* published in 1675 in the *Acta Sanctorum*, Mabillon's *De re diplomatica* of 1681 formed the foundation of two disciplines: diplomatic and palaeography. The palaeographical part of his project grew out of Mabillon's wish to use script as one of the criteria for localizing a document in time and space. He summarized his position early in the work when he wrote that 'One way of writing was found amongst the Romans, another amongst other peoples [*nationes*]. One may identify almost as many

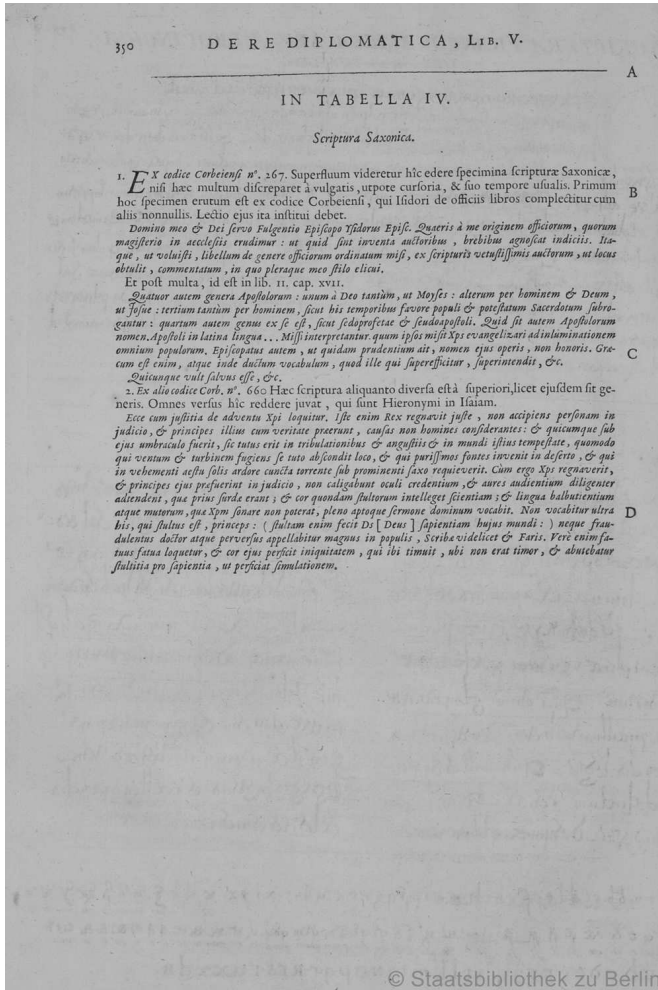


Figure 1. Page 350 of the second edition of Jean Mabillon's *De re diplomatica* with commentary on Tabella IV, the script samples and alphabets on the facing page (Fig. 2). After giving brief information about the script and manuscripts Mabillon printed a transcription (sometimes abbreviated) of the facing passages. (From: Mabillon, Jean: *De re diplomatica libri VI – Ed. 2 ab ipso auctore recognita, emendata et aucta* – Paris 1709. In the Diez Collection of the Staatsbibliothek zu Berlin – Preußischer Kulturbesitz, Bibl. Diez fol. 615. Used with the kind permission of the owner and holder of the rights for the digital version, the Staatsbibliothek zu Berlin.)

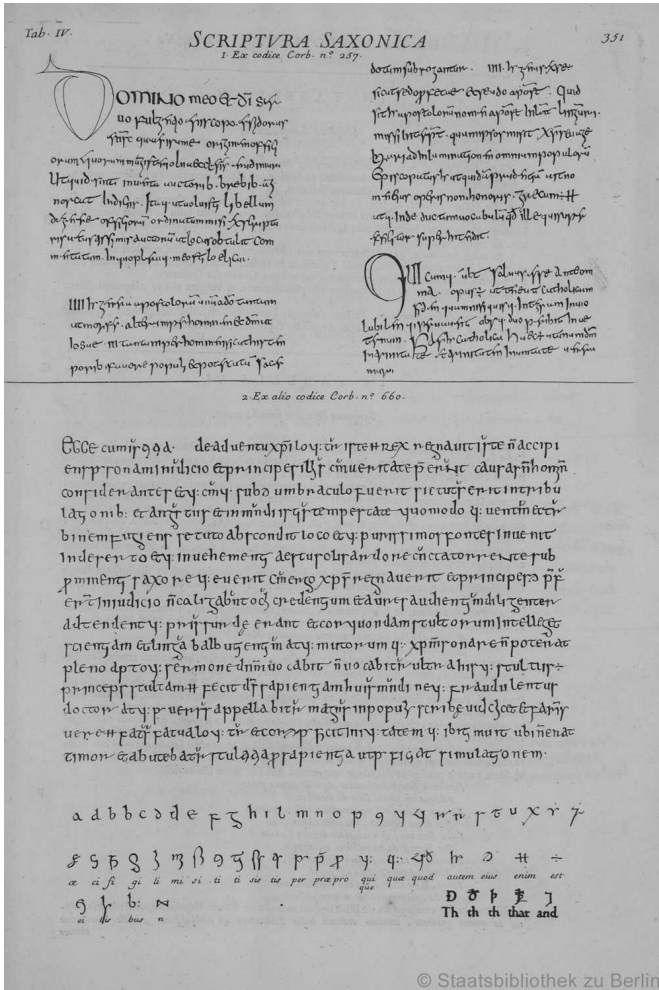


Figure 2. This page (351) faces the commentary printed in Fig. 1. The two engraved script samples are designed to show the reader a 'typical' manuscript in Mabillon's *scriptura saxonica*. Below the two script samples are alphabets intended to give an idealized version of the script. Note that an extra set of characters has been added with characters used to write the Anglo-Saxon language (the plate is unchanged from the first edition). (From: Mabillon, Jean: *De re diplomatica libri VI - Ed. 2 ab ipso auctore recognita, emendata et aucta* - Paris 1709. In the Diez Collection of the Staatsbibliothek zu Berlin - Preußischer Kulturbesitz, Bibl. Diez fol. 615. Used with the kind permission of the owner and holder of the rights for the digital version, the Staatsbibliothek zu Berlin.)

ways of writing as there are different peoples, though the ways of writing of each people is different at various times' (Mabillon 45). He went on to argue that as the Goths and Lombards conquered Italy, their scripts replaced Roman script. Because he linked script and national identity, Mabillon had no need to explain how the different national scripts were related; the only problem was to explain how the changes within the national scripts occurred over time so that these could be dated. Mabillon's presentation of his results in Book Five of *De re diplomatica* also set a pattern that palaeographical manuals follow to this day. We can examine Tabella IV and its facing page as one example. The right-hand page 351 (Fig. 2) shows examples of Mabillon's *scriptura saxonica* from two Corbie manuscripts (the manuscripts are now in St Petersburg, Lat. Q v I 15 and Lat. F v I 3 respectively Number One and Two), while the facing page (p. 350, Fig. 1) has a transcription and short commentary.

In presenting the scripts in this way in the plate Mabillon sought to give a sense of how texts looked on the page as well as a set of letterforms abstracted from the scripts of individual scribes. By juxtaposing the hand of a single scribe with an artificial alphabet, the page was designed to help someone classify a given manuscript (Mabillon 343). Eventually, these letterforms were treated like type, which is to say that they were considered as single graphic entities that arrived simultaneously on the written surface rather than being traced upon it in a series of strokes. The origin of this way of looking at script lies in the early attempts to create generalized alphabets that would represent a class of script—in other words something corresponding to the form the scribe had in his or her mind before writing. Once these idealized alphabets had been created, classification of the script found in a manuscript was a matter of finding the alphabet it most nearly resembled. This method has advantages in being able to localize scripts, but disadvantages in that it has no model for showing the relationships among scripts.

As influential as Mabillon's insight about the relationship between peoples and scripts was, it was soon challenged by Scipione Maffei, who claimed he could prove that such national scripts never existed in the same way he could prove a geometrical proposition (Maffei 113). Maffei argued that Mabillon's national scripts were simply modifications of three basic forms of Roman script: capital, minuscule, and cursive. In doing this Maffei argued for a change in the basis for Mabillon's system, but he did not argue against the structure erected upon it, i.e. the names for scripts or their dates. As important as Mabillon and Maffei were, it was the *Nouveau Traité de Diplomatie*, published between 1750 and 1765, that set palaeography on the trajectory it followed for some 200 years. Written by the Benedictines Toustain and Tassin, the work deliberately follows Mabillon and defends his approach against critics. In working out the implications of Mabillon's views, however, the *Nouveau Traité* did not reject Maffei out of hand, but remarked in the preface of the first volume that while Maffei's project claimed to speak more to the eye than to the intellect, their project attempted to speak both to the eye and the intellect (Toustain and Tassin 1 xxi). And in the next volume, the

authors summarized Maffei's arguments against Mabillon, while only partially refuting them (Toustain and Tassin 2 283–88). And, of course, the *Nouveau Traité* introduced the term *demi-onciale*, which has bedeviled palaeographers to this day. So influential was this formulation that the writers of the *Dictionary of science, literature, and art* described diplomatic in 1867 this way: 'The principles laid down by Mabillon [...] were more fully developed about the middle of last century, in the *Nouveau Traité de Diplomatique*, which has left little to be done by subsequent labourers in this field beyond the duty of translation, compilation, or abridgement' (Brandt and Cox s.v. diplomatic). But so it was not to be.

In 1937 Jean Mallon first addressed the problem that had lain dormant since Mabillon: how could letters evolve? He followed that article with a demonstration (both in print and on film) of how the letter **b** might have evolved and he ended the decade by producing along with Robert Marichal and Charles Perrat a volume of plates and transcriptions entitled *L'écriture latine de la capitale romaine à la minuscule*. Nothing, at first glance, could possibly seem less controversial; yet in the introduction there are rumblings of disquiet about the state of a discipline confined to the field allotted it in the seventeenth and eighteenth centuries and only timidly venturing out. The authors contented themselves with remarking that any justification for breaking down the barriers would be premature (Mallon et al. 2). A hint of what was to come, however, lay in the fact that the facsimiles were organized into three groups—scripts written on hard materials, the scripts of documents, and the scripts of books—and that none of the scripts had names. The promised *exposition de doctrine* came first in Marichal's lengthy 1948 article entitled *De la capitale romaine à la minuscule* (Marichal) and then in Mallon's *Paléographie romaine* of 1952. These publications not only argued that palaeographers ought to consider all the written monuments of a period but also gave a tool for analyzing scripts using the movements of the pen (*ductus*) to show the similarities underlying many seemingly diverse letterforms. As we saw with the volume of plates from 1939, this focus on continuity and evolution made the classification of scripts, much less their names, almost irrelevant. And although his critique of the naming system is devastating and he complained bitterly about the refusal of these inadequate and inaccurate terms simply to disappear (Mallon 1982 261), he never seems to have recognized the need they fill, much less offer an alternative. Perhaps predictably, then, many palaeographers writing in English and German tend not to adopt Mallon's approach to the subject or even at times to be aware of its existence as an alternative. As Julian Brown put it in 1982: 'Silly though they undoubtedly are, most of us have declined to accept Mallon's contention that the scripts should be renamed in some manner that reflects their natures and historical relationships to each other: for one thing, they are too deeply embedded in the literature, and for another we all know what they mean' (43). Palaeographers writing in French and Italian, on the other hand, have tended to

acknowledge the importance of Mallon's work, but still remain bound to the schema imposed by the names of scripts.

The result of this historical development, then, is that palaeography is a discipline with inadequate nomenclature that has changed little since it was canonized by the *Nouveau traité*. This nomenclature does not reflect—indeed is often a barrier to understanding—how scripts are related to each other and how they evolved. But, as the refusal to confront the challenges raised by Mallon shows, this nomenclature seems to be the tool with which palaeographers choose to work, even though problems have been recognized for almost a century, as we see from Lowe's problems with his list of half-uncial manuscripts. Nomenclature is especially problematic in the greatest period of diversity and change, i.e. in the period between Roman and Carolingian scripts. It would be easy enough to agree with Brown that the names are silly and we all know what we mean anyway, but perhaps a more fruitful way forward is to recognize that the challenge of deciding what to observe and measure is a moment of opportunity for palaeographers.

4 A Possible Course for the Future

The future for the discipline that Bernhard Bischoff foretold, if taken to its extreme, seemed to imply palaeography without palaeographers: the work would be done by measuring machines ingesting manuscripts at one end and producing analyses and transcriptions without human intervention at the other. As I have argued above, such a machine would be impossible to build because we could not always tell it what to observe. As we have also seen, however, palaeography is not a monolithic discipline; instead, there are two fundamentally different views of what palaeographers ought to be doing. On the one hand, Bischoff represents a Linnaean approach that lays great emphasis on classifying scripts and recognizing developments within a single type of script. This view of palaeography goes back to Mabillon and sees palaeography as a *Hilfswissenschaft*—its goal is to localize manuscripts in time and place and to transcribe their texts correctly so that these results can be used in larger historical narratives. Mallon, on the other hand, represents a Darwinian approach, which sees the fundamental questions as explaining the evolution of scripts and their relationships to each other, as well as looking for the mechanisms that explain these phenomena. In this view, palaeography is less concerned to deliver results to other disciplines than it is to discover its own rules to explain the ways that scribes created and modified scripts. While the Linnaeans use their classification schemes to locate the creation of a manuscript at a single point in time and space, the Darwinians are more interested in placing a given script within the internal logic of script evolution and less concerned with mapping it onto a time and place in the past.

In order to talk about the future of palaeography in general, as well as the ways that computers can be used in it, it is important to distinguish these two approaches, even though they are by no means mutually exclusive. No matter how one views palaeography and its aims, technology has certainly offered something to everyone. As noted above, the most significant contribution to the study of manuscripts of the digital age has been the enormously expanded access to an enormously expanded number of manuscripts. In addition, the use of such techniques as multispectral imaging have made it possible to read writing that was previously illegible. If nothing else, then, technology has enlarged the corpus of writing considered by palaeographers in just the same way that etching and photography had earlier. In addition, the analysis of these images holds out the possibility that many tasks of the palaeographer could be automated.



Figure 3. These four letters begin the word *estimo* in the preface of Adomnán of Iona's *Life of St Columba*. Although computer analysis often focuses on the static shapes of letters, note how much information would be lost in such an analysis. We can tell, for example, that the stroke that forms the *e* begins at Arrow A, while the stroke forming the loop begins at Arrow B. Note, too, that at Arrow C, the *t* and *i* are written as separate letters, not as a ligature. (Schaffhausen, Stadtbibliothek, Gen. 1, p. 1a.14).

In fact, it is more in the analysis of these images that the two approaches to palaeography require different approaches from computers. For the Linnaeans, automated techniques offer the ability to compare hands writing scripts of the same type. For example, given a corpus of manuscripts in Carolingian minuscule, machine analysis could perhaps be able to identify the hands of individual scribes or perhaps to create subcategories within the corpus based on the frequency of variant letterforms—just the sort of project that Derolez praised and just the sort of project that seems to represent the mainstream of automated approaches. Indeed, if this approach were applied to the range of manuscripts that Lowe considered for his list of half-uncial manuscripts, perhaps it would be possible to develop criteria that grow out of the corpus rather than being imposed upon it. Yet it is the Darwinians who may have the most interesting

collaboration with technology. One fruitful approach for digital analysis, for example, could be attempting to analyze letterforms into their component strokes and pen angles. To take an extremely elementary example, Fig. 3 shows a group of eight strokes composing four letters (*esti*) from the first page of the early-eighth century manuscript of Adomnán of Iona's *Vita Columbae* now in the Stadtbibliothek of Schaffhausen in Switzerland. When we look closely, we see that these graphic signs are related in interesting ways: the strokes that make up the *e* and *s* have been modified and combined to form a ligature and the slight irregularities in the *e* marked by the Arrows A and B represent the beginning of the left-hand loop and the bow respectively of the *e*; the horizontal stroke of the *t* begins at the same place that the final stroke of the *s* ends, while the *t* and *i* might appear to form a ligature, but the way the strokes join at Arrow C show that the strokes of the two letters have not been modified, they are simply tightly spaced. No human palaeographer has the patience to go through an entire manuscript, much less an entire body of manuscripts, at such a level of detail, but this detailed description shows the amount of information to be gained from the close analysis of a fairly typical set of letters in a minuscule script—without even mentioning pen angle and line width. In other words, manuscripts have the potential to deliver up a vast quantity of information about how scribes wrote. Perhaps the automated analysis of script will soon turn its attention to reconstructing the motion of the scribe's pen on the page and following Mallon's lead explore the ways that these strokes evolved. It is then that we will begin to be able to measure the scribe's art.

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