

GREGORY HEYWORTH

From Technology to Text: Reading and Editing the Lacunose Manuscript

... *facilis descensus Averno*
Aeneid, 6.125

Nature, as Aristotle famously suggested, abhors a vacuum.¹ Philologists feel much the same way about the lacuna—that absence, that hole in the text, that stain, that blot that obscures. For those for whom reading old texts means a great deal, and being able to read them accurately means even more, the lacuna declines easily from a figure of absence to one of anxious presence, from objectivity to subjectivity. While the dispassionate scientist in us may see an absence as a material defect, the humanist, who holds a professional stake in the text, discovers a personal failing. The letters on the edge of a lacuna taunt like an unfinished Sunday crossword on Monday morning. We possess the clues, we know the language, the sources, the historical and literary context; more embarrassing still, we have a degree and a career built on reading hard texts. To leave the lacuna is to acknowledge publicly our own intellectual gaps. How easy it is to move from to <>, from absence to conjecture.

What follows is a cautionary, and confessional, consideration of editing the lacunose manuscript in an age of technologies—multispectral imaging, statistical processing, neural networks—that provide both aid to, and cover for, editorial decisions. Editing a manuscript is, of course, subtly different from editing a text inasmuch as texts are notional constructs and manuscripts material ones. Of late, that distinction has been further vexed by technologies that challenge the status of a text as a purely human production, as well as the role and responsibility of an editor, by enhancing a reader's ability to see more than what is visible to the naked eye, as well as to recognize patterns that might otherwise be imperceptible to the human mind. My argument will draw primarily on two manuscripts, both of which I have transcribed and/or edited. Throughout the entire process, I am fortunate to have had the best technical help imaginable, both in imaging, image-processing, and later in optical character recognition, what I call forensic palaeography. That said, much of the capture and processing I performed myself, and so the editorial decisions remain, for better or for worse, my own. In other words, my own subjectivity as a textual scholar is to blame at every turn. In the pages that follow, I'd like to worry the problem of tendentious decisions in editing and the role technology plays in them both in theory and in practice.

MATERIAL MOVANCE

In producing a scholarly edition of a classical or medieval work, and in the absence of an author's autograph copy, how is a textual editor to account for and correct the changes in a work that accrue over the many years and many copies that constitute a 'text'? For centuries, philologists' efforts to solve that problem have been predicated on a semantic distinction between a 'text' and a 'manuscript witness'. When a piece of writing loses material connection to its author, circulating unmoored and unauthorized, it becomes a mere 'text', the notional construct of a literary or historical work.² Manuscript witnesses, by contrast, are things: the group of (imperfect) versions or 'variants' that constitute the physical record of a text writ large. The task of the scholar, traditionally conceived, has been to reconstitute the text from manuscript witnesses, or as Giovanni Lamola,

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¹ Aristotle, *Physics* 4, 6–8.

² For a more historically-nuanced definition, see Martens, 'What is a Text?'. Martens gives one aspect of the definition of 'text' as 'a complex of all the versions and deviations belonging to a work' (p. 210).

the Bolognese philologist of the first half of the 15th century, put it, ‘omnium secundum priorem textum restituere’.³ In 1968, Nigel Wilson and Leighton Reynolds reaffirmed Lamola’s rule when they argued that role of the textual critic is to ‘restore the texts as closely as possible to the form they originally had’, by which they meant to compare or collate variants and correct mistakes.⁴

Working at the same period as Wilson and Reynolds, Paul Zumthor went so far as to argue for an even more radical notion of the text. Given the significant discrepancies in readings among variants of medieval texts, especially of anonymous works, neither originality nor singularity, he maintained, can serve as a defining quality of the medieval literary work.⁵ Rather, scribes, along with their additions and mistakes, participate in the creation of a text as unacknowledged co-authors of a sort. This fluidity in the idea of the text’s composition he termed ‘mouvance’.

Now, *mouvance* is a term of repute heretofore uniquely associated with one method of ‘restoring’ (to use Lamola’s term *restituere*) the most reliable or best text.⁶ Another form of *mouvance*, what I call ‘material *mouvance*’, plays a less well-known role in the history of textual editing. A manuscript witness decays over time in a variety of ways—fading, damage, palimpsesting, chemical reagents—rendering it less legible. This too is a form of *mouvance*, making an individual manuscript non-identical to itself. Since at least the 16th century, textual scholars have used chemical reagents to revivify text that has become illegible through age, turning back time, as it were, on the individual manuscript witness.⁷ Cardinal Angelo Mai is perhaps the best known among scholars who produced editions aided by chemical reagents to reveal palimpsested undertexts, including Cicero’s *De re publica* and the complete works of Vergil.

The ethical quandaries of the use of chemical reagents increasingly dogged textual scholars as the effects became better known. First, reagents always damage the manuscript on which they are deployed, leaving it permanently less legible than before. Second, the heightened legibility of a passage is often very short lived, sometimes lasting only a few minutes. Given the damage they cause, are the readings they afford worth the risks to the object? Is the brief window of legibility sufficient time to extract an authoritative reading? If only one scholar has the opportunity to benefit from a reagent-enhanced reading, is that reading inherently suspect because it can never be confirmed or duplicated by other scholars? These issues rose to a level of crisis by the late 19th century, leading to a general prohibition against the practice at the St. Gall International Conference on the Conservation and Restoration of Manuscripts of 1898.⁸

Today, however, various non-destructive imaging techniques have enabled some scholars to ‘turn back time’ on manuscript witnesses—multispectral imaging, x-ray fluorescence—counteracting material *mouvance* without the deleterious concomitants of chemical reagents. This technology, while widely acknowledged not to do harm,⁹ nonetheless poses a variety of ethical and technical problems for those few scholars who are able to employ it, similar to those of the era of chemical reagents. Given the esoteric nature of both the imaging process and the image processing techniques and algorithms, can scholars reliably verify the methods and readings of scholars using these technologies? Can the results be falsified or altered in subtle ways that compromise the authority of readings? Has technology itself become a witness that cannot be interrogated in the process of textual editing? Each of these questions points to what might be called digital lacunae in the process of technology-aided textual editing, which I would like to address in the context of resolving actual, material textual lacunae.

³ As quoted in Rüdiger, *Die Wiederentdeckung*, 553.

⁴ Reynolds and Wilson, *Scribes and Scholars*, 207. On the standard editorial practice of collation and recension, see Maas, *Textual Criticism*.

⁵ Zumthor, *Essai de poétique*, 72ff.

⁶ On ‘best-text’ method, see Bédier, *De la formation des chansons de geste*, 30: ‘Au lieu de s’épuiser à la recherche des hypothétiques modèles perdus des chansons de geste, il faut les accepter telles qu’elles sont, dans les textes que nous avons.’

⁷ In 1759, the Maurist scholar René-Prosper Tassin describes the recipe for and, for the first time, the use of chemical reagents on manuscripts in *Nouveau traité*, 459, note 1.3.

⁸ On which, see Posse, *Handschriften-Konservierung*, 4ff.

⁹ See Bearman *et. al.*, *Measuring the Illumination Exposure*.

MULTISPECTRAL EDITING: DRESDEN OC. 66

In 2013, Daniel O'Sullivan and I published the first volume of the first edition of the 14th-century French poem, *Les Eschez d'Amours* (Dresden MS oc. 66), a unique manuscript badly damaged in the firebombing of Dresden in 1945 and considered lost. I am currently finishing the second and last volume. Multispectral imaging that I performed in 2009 and again in 2014, and ongoing image processing, provided images of enhanced legibility far beyond what can be achieved with UV lamps. Because the only other witness to the poem was a fragment—Venice Fr. App. 123 (V)—the edition of *Les Eschez d'Amours* relied primarily on this single manuscript from Dresden (D), along with collation from V and occasional scraps of pre-damage transcription of D published in articles in the 19th century.

The Dresden manuscript's numerous lacunae fall into several discrete categories, each requiring different processing methods and levels of editorial intrusion. The most common were faded, water-damaged passages largely illegible in visible light, but clearly legible in multispectral processed images (Fig. 1). Another sort were passages obscured by rubrics that, when the manuscript lay wet at the end of war, had transferred from one folio to another, forming a kind of red mirror-text over black (Fig. 2). The most difficult lacunae were those in which East German conservators in the 1980s used urea to 'wash' excess ink off the folios, causing parts of the manuscript to become translucent (Fig. 3), or in which parts of the manuscript had cracked and crumbled away entirely to be replaced by stabilizing material.

Behind every textual lacuna lies a series of editorial choices and sigla that describe them, organized according to levels of confidence in either traditional text critical techniques (collation from other witnesses) or technologies. Perhaps the most significant editorial choice affecting the *Eschez d'Amours* was silence. Lacunae such as those in Figures 1 and 2 were not even noted critically as constituting lacunae; transcription from multispectral images of passages in which the text had so degraded as to be illegible, or those in which the obscuring transfer rubric was digitally lightened to permit transcription of the *scriptio inferior*, were treated as more reliable than firsthand inspection in visible light. A diplomatic edition, which this was not, may well, and perhaps should have, distinguished between text visible to the naked eye and that legible only through the intermedium of technology. In these cases, I treated technology-enhanced readings as superior in authority to the witness both of the fragmentary variant (Venice) and to that of 19th century transcriptions of Dresden. The most serious damage (Fig. 3), required collation from either the variant V or from pre-damage readings of D when available. When not available, we chose to conjecture (set off in angled brackets) based on partial allographs, aided by the exact measurement of the width of individual letters, number of syllables, and rhyme.¹⁰ In these cases, my transcription of V was placed in the text in italics, while 19th century witnesses of D were placed in square brackets, an implicit hierarchy founded on the extent to which the reading was mediated by other scholars and the proximity to our base manuscript.

The most controversial of our editorial assumptions turned out to be the one to which we gave the least thought. A generally positive review of the edition in *Digital Philology* included the following criticism: 'Given the digital work undertaken, it would be of great interest to many to be able to view the multispectral images taken of MS D (it is digitized here under normal viewing conditions)—making these available online would be of great interest to those wishing to better understand the editorial process under such challenging conditions.'¹¹ Indeed, understanding the 'editorial process' in the absence of the primary evidence is not only reasonable but necessary. The only reasons we did not provide evidence of the multispectral processed images were the cost and cumbrance of including some in the published edition. That said, technology and its complexities often serve as cover for unscholarly or unethical decisions. The same scientific rigour applied by textual critics such as Lachmann and Maas must, in some way, translate into the era of technology-aided editions.

The need for transparency and rigour is matched by the difficulty of implementation. When multispectral images of a manuscript are captured, they exist in their pristine form as a series of photographs of the same folio under various wavelengths or bands, each revealing slightly different features. While in their raw form they often afford a marginal enhancement to legibility, they are rarely transformative. After capture, the raw

¹⁰ Like many French poems of the period, the *Eschez d'Amours* is written in rhyming octosyllables. All conjectures were placed in angled brackets, see Heyworth and O'Sullivan, *Eschez*, passim.

¹¹ Rose-Steel, *Eschez* review, 300.

images are usually transferred immediately to the institution that owns the object. These are the images that are accessed most easily by scholars and the public and the ones by which they judge the degree of legibility, erroneously so inasmuch as the raw images often reveal only a fraction of what can be read after image processing. Image capture represents less than twenty percent of the work of recovering text. Statistical image processing, often involving such algorithmic interventions as Principal or Independent Component Analysis or Minimum Noise Fraction, is an iterative process of interaction between scholar and image processor, producing multiple different variants of every folio that may take months, or even years. These images offer the most marked changes as manifest in Figure 4 (Henricus Martellus Map under UV, IR, and multispectral). Any multispectral digital facsimile of a manuscript would necessarily need to exist as a digital resource with the capacity *both* to store multiple large images *and* to present multiple versions—processed and unprocessed—of the same passage simultaneously, a practicable but non-trivial endeavour.

More challenging than implementation, however, are the transparency of methods and completeness of metadata that are the concomitants of editions aided by multispectral imaging. To prevent falsification of results, informal standards employed by many of the major practitioners of multispectral imaging for cultural heritage have evolved around the principle of non-destructive editing. The opposite of what we commonly call ‘photoshopping’, non-destructive editing never adds or subtracts data. Rather, data are enhanced and interpreted using algorithms in such a way that all results are duplicable and reversible, amounting to a series of manipulations that are recorded in metadata that accompany the image. Crucial parts of that process, however, are not easily automated or recorded. In most supervised image processing methods such as Principal Component Analysis and Independent Component Analysis, the imaging scientist selects specific regions of interest (ROIs) in the damaged manuscript that capture the range of spectral characteristics in the form of statistics that the algorithm will apply to a spectral image. On a palimpsest, for example, an ROI might reasonably isolate the *scriptio inferior* alone, or perhaps a range of areas with various types of damage. Like various windows onto the same garden, different ROIs applied to an image set can produce radically different views. And yet, because specific ROIs cannot be easily described mathematically, they are preserved only as spatial subsets, files akin in appearance to a gerrymandered map of a country. To reproduce, and thus to verify, recovered text, one must have access to the original ROIs, which are not commonly transmitted in metadata. Without them, textual readings are without scientific foundation.

While incomplete metadata sets represent unintentional lacunae in the editorial record of an object, other lapses involve intentional alteration of the data. The tacit principle of non-destructive image processing has never been established as standard practice. Between 2001 and 2004, the most important digital imaging project for damaged manuscripts in the world was Rinascimento virtuale. A European project coordinated by the University of Hamburg and funded by the European Commission in Brussels, boasting fifty partner institutions across Europe, Rinascimento virtuale represented the state of the art in palimpsest recovery and research. The group’s multispectral imaging team, led by Daniele Broia, developed a method of processing what they termed ‘virtual restoration’, a technique that produced a clarity both in under- and overtexts that was nothing short of spectacular.¹² Fotoscienifica’s reputation for high quality afforded it entrée to the most important collections of manuscripts in Europe, from the Vatican to the British Library, ten years beyond the end of the Rinascimento virtuale project. While the exact details of Broia’s method have never been described in technical detail, it began to attract concern among textual scholars. Visually, Fotoscienifica’s processed images were remarkable for their lack of ‘noise’—that is to say, the piebald smudges and poor contrast typical of damaged parchment. His was a uniformly creamy, mottled beige, regardless of how stained or brown the original. Overtexts were coloured to match the parchment, causing them to disappear like camouflage into the background, while undertexts became uniformly dark brown, magically devoid of moles, and all with sharply defined edges. Only scholars with some sophistication in imaging and image processing could recognize these as examples of re-touching—that is, the digital colouring in and erasure of noise that can, with effort, be accomplished by digital image manipulation. Peter Stokes, a noted palaeographer and computer scientist, was among the first to cry foul. Broia’s method, as I have learned from scholars who worked with him, seems to have involved creating a typology of letter forms that he would use as a template for ‘enhancing’—read ‘colouring in’—an undertext.

¹² See <http://www.bml.firenze.sbn.it/rinascimentovirtuale/pannello26.shtm> (accessed 01.07.2023). High quality images of Fotoscienifica’s palimpsest work are difficult to obtain, although I have personally inspected several examples.

Thus, in an article on digital paleography in 2008, Stokes commented acutely: ‘In some cases of software designed for palaeographical analysis, as indeed for other applications of digital humanities, it is not clear exactly what the computer is doing, either because the particular technique requires a lot of ad hoc human intervention which is not properly documented, or because the software is proprietary rather than open-source. One example of this is the image enhancement performed by Fotoscientifica, a company which, when led by Daniele Broia, used to recover text from damaged manuscripts using multispectral photography and image enhancement (Fotoscientifica). Their results were spectacularly successful and yet their services were sometimes not used because of concern about the degree to which they enhanced and the lack of openness about what they had enhanced and how they had done it.’¹³

A prerequisite to any future technology-aided editions should take its cues from Stokes’s warnings. All methods of image processing and capture must be able to pass basic tests of transparency, openness, and scientific reproducibility while adhering to an ethical standard of non-destructive image preparation. Granting agencies and publishers alike must be encouraged to agree upon these standards, and agree as well to provide image evidence for all readings. For some, this copiousness of supporting data and metadata is not only cumbersome, but inherently dangerous to the authority of textual editors whose readings of lacunose texts will necessarily attract attention through an open online publication of their base image data. A. S. G. Edwards is among those textualists for whom the chimera of digital facsimiles as concomitants to editions threatens more than it gives benefit. Thus, in an article in the *Times Literary Supplement* entitled ‘Back to the Real?’ he impugns the value of digital surrogates, with specific reference to the digital *Codex Sinaiticus* that had attracted over 10,000 hits a month from the general public. ‘That might seem a strong justification for digitization’, he argues, ‘but it seems doubtful whether even a small fraction of that number have the appropriate training—codicological, linguistic and textual—to approach the work in an informed way. If my audience analysis is even broadly correct, the British Library is investing not in scholarship, but in a new branch of the entertainment industry’.¹⁴

Indeed, demands for an open forum for a branch of scholarship that is inherently esoteric and specialist-driven would place the entire field at risk to uninformed scrutiny. Of course, such has always been the case in many technical fields—medicine, engineering, physics, law. More perilous still, however, is the undermining of readers’ confidence in the literary copstones of our culture. Until the technologies that mediate our understanding of our collective cultural heritage can be rendered if not transparent, then openly accessible and comprehensible, we are obliged as textual scholars to tread the slippery slope, as Vergil reminds, ‘hoc opus, hic labor est’.

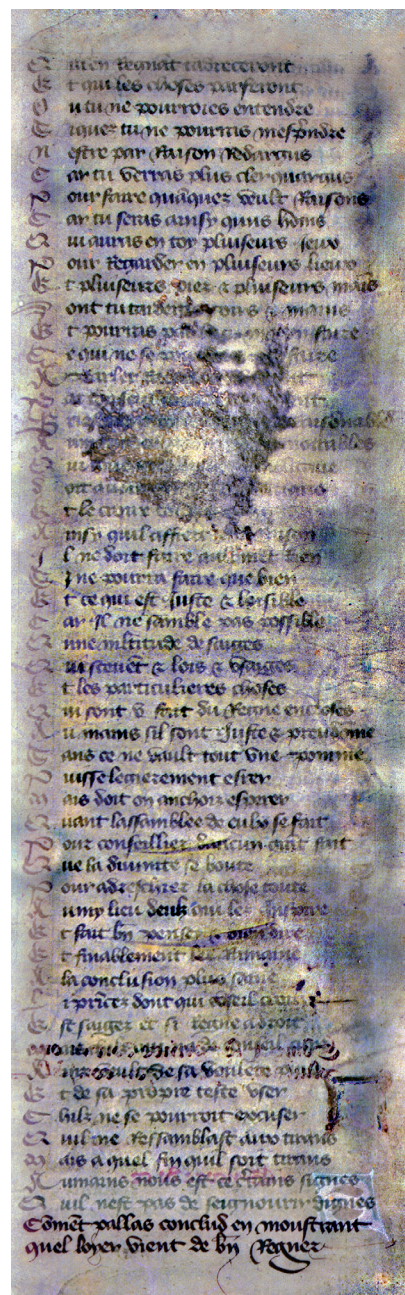
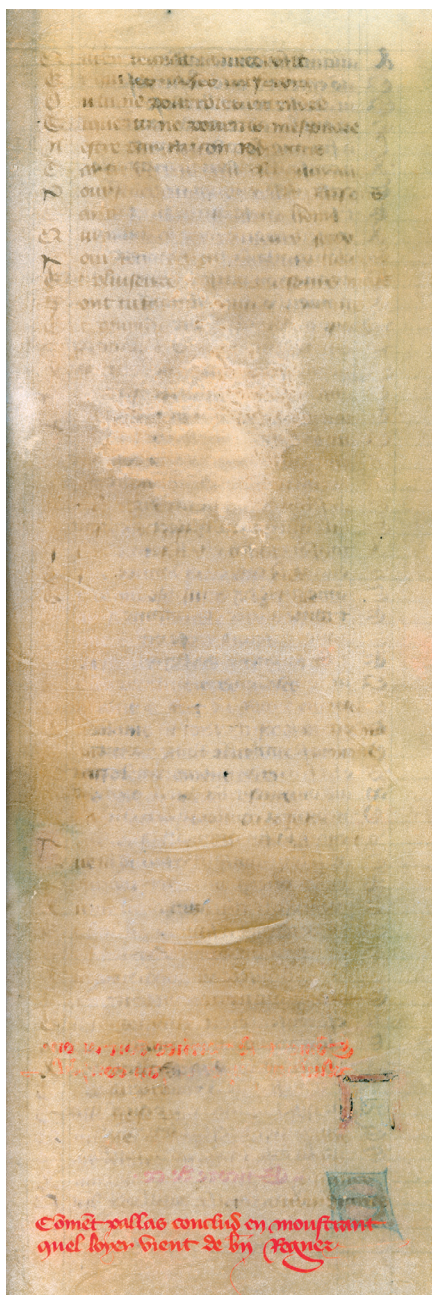
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¹³ Stokes, Computer-Aided Paleography, 321.

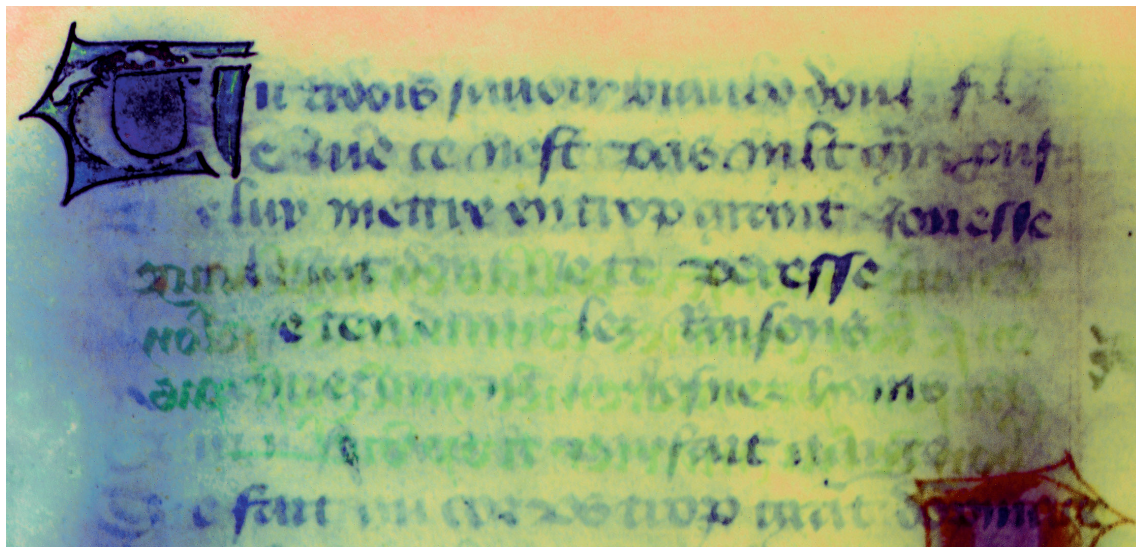
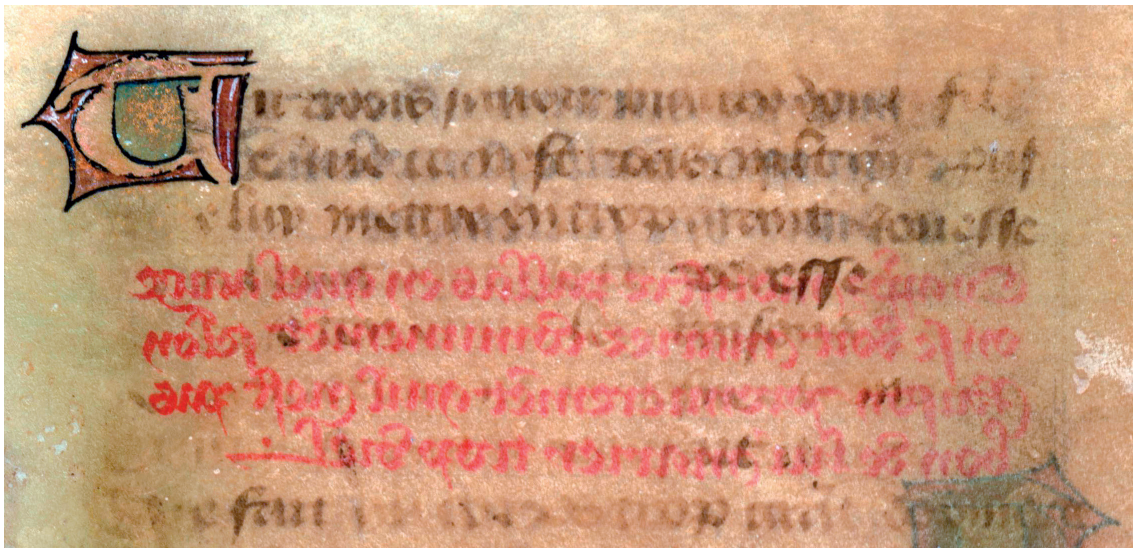
¹⁴ Edwards, Back to the Real?

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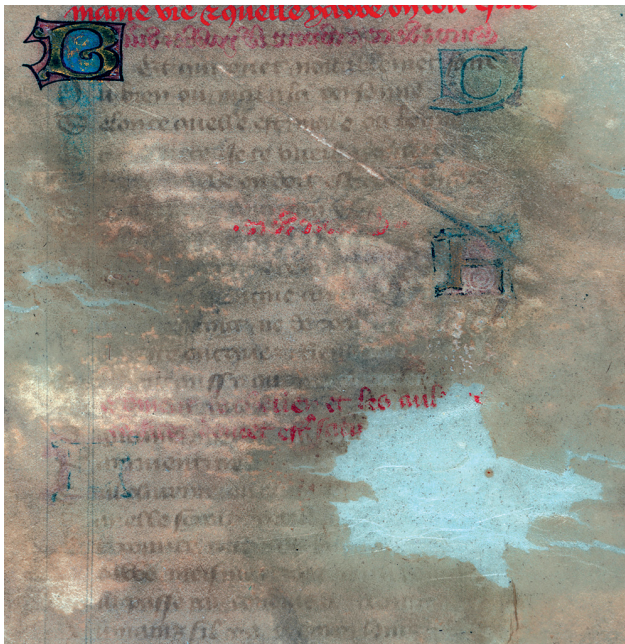
Qui en regna(n)t tadreceront
Et qui les choses parferont
Ou tu ne pourroies entendre
Siquez tu ne pourras mesp(re)ndre
Nestre par raison redargus
Car tu verras plus cler quargus
Pour faire qua(n)quez veult raisons
Car tu seras ainsy quns ho(m)ms
Qui auras en toy pluseurs jeux
Pour regarder en pluseurs lieux
Et pluseurs piez et pluseurs mai(n)s
Dont tu taideras soirs et mains
Et pourras par la ... m...n faire
Ce qui ne se pou..... et p<ar>faire
A parler rais<onnable>ment
Par toy seul.....ent
Brief<m>en<v> tous..... <v>aiso(n)nables
Auma<ins>..... m... nottables
Qui tous ...et.....<pu>ob>blicque
Doit auoir<domes/auten>tique
Et le croire tel {1s}son
Ainsy quil affiert raison
Il ne doit faire ault(re)me(n)t rien
Si ne pourra faire que bien
Et ce qui est juste et loisible
Car il ne samble pas possible
Que m(ou)ltitude de saiges
Qui sceue(n)t et lois et vsaiges
Et les particulieres choses
Qui sont v fait du regne encloses
Au mains sil sont justes preudo(m)me
Sans ce ne vault tout vne pomme
Puisse legierement esrer
Mais doit on anchois esperer
Quant lassamblee de eulx se fait
Pour conseilier daucun gra(n)t fait
Que la diuinite se boute
Pour adreshiez la chose toute
Au my lieu deulz qui lez inspire
Et fait b(ie)n penser et bien dire
Et finalement lez rmaine
A la conclusion plus saine
Li pri(n)ces dont qui co(n)seil croit
Est saigez et si regle a droit
Mais chilz qui na de conseil cure
Ainz veult de sa voule(n)te pure
Et de sa propre teste vser
Chilz ne se pourroit excuser
Quil ne ressamblast aux tirans
Mais a quel fin quil soit tirans
Aumains nous est ce c(er)tains signes
Quil nest pas de seignourir dignes
Co(m)me(n)t pallas conclud en moustrant
quel loyer vient de b(ie)n regner

Fig. 1(a-c): Dresden OC66, f. 81r, *Eschез d'Amours* (RGB, MSI, transcription)
(© Sächsische Landes- und Universitätsbibliothek Dresden)



T u redoys sauoir biaux doulz filz
 Que ce nest pas m(ou)lt g(ra)nz p(ro)ufiz
 De luy mettre en trop grant jonesse
 Et lestat dont je te peresse
 Et je ten diray lez raisons Premièrement li josnez homs
 Qui nest pas de parfait aaige
 Se fait au corps trop gra(n)t do(m)pimage

Fig. 2(a-c): Dresden OC66, f. 112v, *Eschez d'Amours* (RGB, MSI, transcription)
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**Co(m)me(n)t yavve est neccessaire a hu-
maine vie et quelle yavve on doit eslire**

Briefment cest chose neccessaire
 Et qui puet nottableme(n)t faire
 Ou bien ou mal a la personne
 Selon ce quelle est male ou bonne
 Et p<ou>r ce je te vueil app(re)ndre
 Quelle yavve on doit eslire ou p(re)ndre
 Se.....t pour son vser
 E.....uelle on doit re<garder>
garder premi<erement>
 <Quel>le ne viengne au<cunemen>t
 De lac destang ne de pal<ut>
 Car ceste oncquez riens <ne> valut }
 On doit aussy quoy a er...
 B(ie)n garder que l<ya>vv<e>.... }
 Daucune minure.....
 Par auenture ny..... }
 Sulphurine ou alu<mineux>
 Car elle seroit perille<ux> }
 Et pour ce nest pas b(ie)n s<eure>
 Leavve meismes par nature
 Qui passe par conduis de plong
 Aumainz sil y a chemin long

Fig. 3(a-c): Dresden OC66, f. 142r, *Eschez d'Amours* (RGB, MSI, transcription)
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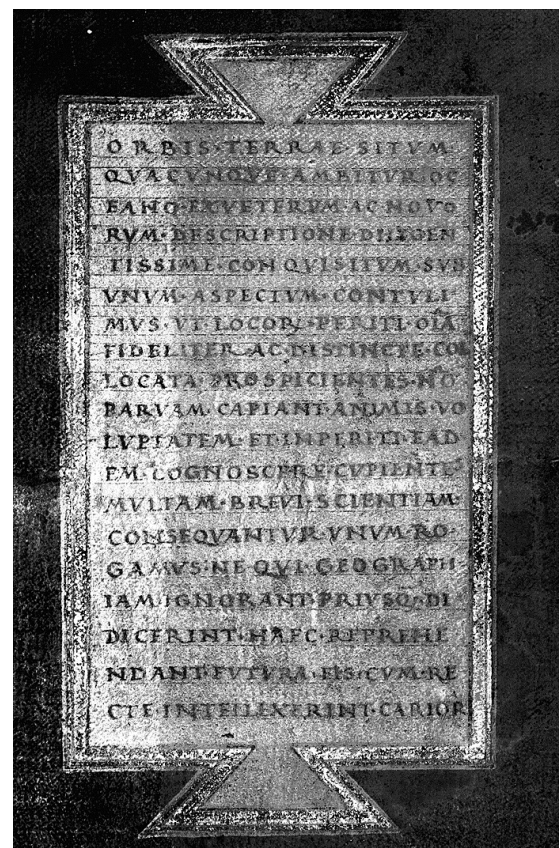
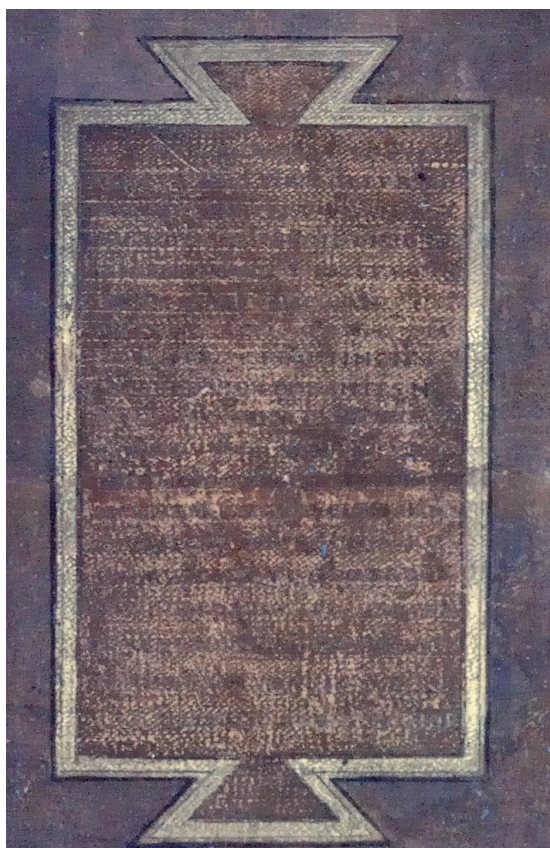
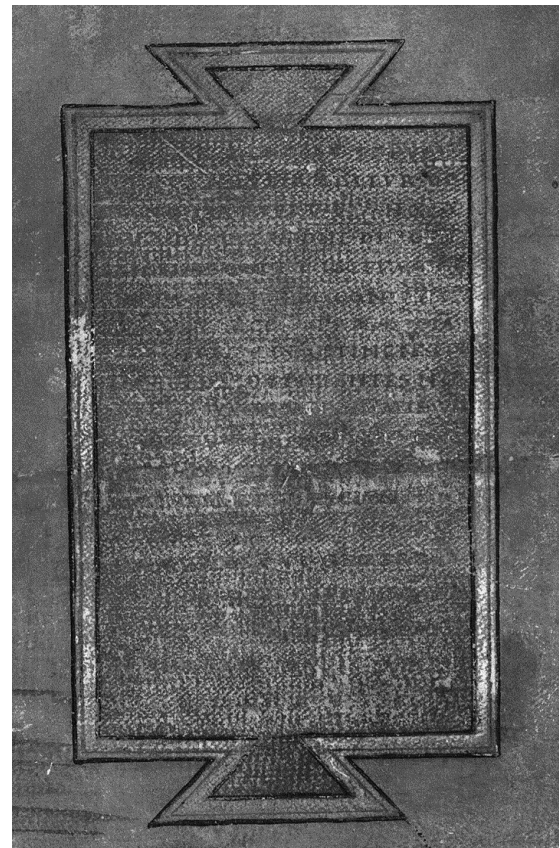


Fig. 4(a-d): Yale University, Beinecke Library, Henricus Martellus Map, 1491 (RGB, UV, IR, MSI)
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