

# Reading Behind the Lines: Ghost Texts and Spectral Imaging in the Manuscripts of Alfred Tennyson

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This article is among the first sustained applications of multispectral imaging and image processing to the study of modern anglophone literature. It recovers previously unreadable variants in the manuscripts of Alfred Tennyson, pioneers methods of multispectral processing as a literary-critical act in itself, and theorizes the consequences of its restored lines and wider applicability as a new critical method. Digitally stripping away deletions in manuscripts has transformative consequences for our relations with literary archives, turning previously examined collections into untapped repositories of lost literary lines now newly visible. The research goes beyond recovering obscured and environmentally damaged lines, advancing processing techniques for corroding nineteenth-century inks and theorizing its applications for editing and genetic criticism. The article's conclusion offers a theorization and critical conceptualization of how each of these methods can contribute to the formal and intellectual-historical study of modern manuscripts. The paper therefore advances the future of digital editing and textual criticism as a form of literary criticism, offers a reading of newly restored lines, and theorizes the potential of its new methods for analysis of material composition, preservation, and literary form.

In the last decade, advances in digital imaging and image processing have catalysed an entire field of study in medieval and early modern manuscripts and art. New artworks are being discovered behind existing masterpieces and erased manuscripts resurrected in ancient palimpsests,<sup>1</sup> while recovered ink signatures of medieval illuminators are allowing scholars to trace the trade routes of pigments in the medieval world.<sup>2</sup> This article sets a new agenda in digital editing by re-tasking

<sup>1</sup> BBC Two documentary unveils new research which rewrites the story of the *Mona Lisa* (pubd online December 2015) <<https://www.bbc.co.uk/mediacentre/latestnews/2015/secrets-of-the-mona-lisa>> accessed 19 August 2024; Roger Easton, Jr, Keith T. Knox, William A. Christens-Barry, and Ken Boydston, 'Spectral Imaging Methods Applied to the Syriac-Galen Palimpsest', *Manuscript Studies*, 3 (2018), 69–82.

<sup>2</sup> Richard Gameson, Andrew Beeby, Flavia Fiorillo, Catherine E. Nicholson, Paola Ricciardi, and Suzanne Reynolds, *The Pigments of British Medieval Illuminators: A Scientific and Cultural Study* (London, 2023); Andrew Beeby, Louise Garner, David Howell & Catherine E. Nicholson, 'There's more to reflectance spectroscopy than lux', *Journal of the Institute of Conservation*, 41 (2018), 142–53.

and reconceiving these imaging techniques for the study of modern anglophone literature.<sup>3</sup> The manuscripts examined in this study are the poetic revisions of Alfred Tennyson: Poet Laureate from 1850 until his death in 1892, and a prolific reviser of his work in both manuscript and print. Using multispectral imaging, we advance both the data acquisition and processing techniques that have had the greatest success in bringing back nineteenth-century draft verse, and we pursue the implications, both practical and theoretical, for literary criticism and editing.<sup>4</sup> By restoring lost variants in Tennyson's manuscripts, we recover text that will be available for inclusion in *The Complete Works of Alfred Tennyson* (Oxford University Press), the first edition to include Tennyson's full manuscript revisions.<sup>5</sup> Beyond establishing new methods for digital editing, and contributing to a flurry of recent debates on the forms of digital editions,<sup>6</sup> this work restores lines that were previously illegible, opening up for consideration stages of composition and revision that have previously been irretrievable—beyond the limits of critical interpretation.

## DIGITAL AND LITERARY METHODS

Textual analysis of poetic manuscripts is at a decisive juncture, and the combination of multispectral imaging and processing can allow layers of ink to be digitally stripped away, revealing earlier variants that have never been uncovered. Pioneering these processing techniques on Tennyson's manuscripts, we are already managing to recover cultural text by analysing parts of verse that had been deleted and blotted. The findings allow us to shed light on the flow, pace, and pauses in Tennyson's original writing, yielding fresh clues as to the order of revision and traces of the creative mind in the act of composition. Such textual discoveries are not only helping to restore and confirm readings of manuscript verse; they also offer fresh evidence for cognitive theory in literature and for a wide array of interdisciplinary studies that explore the material texts of poetry and poetics.

The principal imaging methods enabling this research have been multispectral imaging (MSI), X-ray fluorescence (XRF), and fibre-optic reflectance spectroscopy (FORS). These non-destructive techniques have been used by Beeby in recent years for the analysis of medieval manuscripts,<sup>7</sup> and the equipment developed has crucial advantages for (i) its portability, enabling analysis of special collections which would otherwise be too fragile to move, (ii) its low power, being calibrated to be non-destructive and non-contact, and (iii) its readily portable data.<sup>8</sup> Use of a near-infrared-enabled digital microscope and additional fixed MSI instruments at the University Library, Cambridge, have supplemented this customized MSI and FORS equipment.<sup>9</sup> Multispectral imaging involves the successive imaging of one manuscript folio under many different spectral bands, from infrared to ultraviolet and the visible spectrum in

<sup>3</sup> For details of the project, which was founded by Michael J Sullivan and Andrew Beeby in 2021, see *Recovery of Literary Manuscripts* <<https://www.recovery-of-literary-manuscripts.net>> accessed 20 November 2024.

<sup>4</sup> Equipment initially designed and acquired through AHRC Research Grant AH/R001545/1 (investigators Beeby and Gameson), *The Pigments of British Illuminators: A Scientific and Cultural Investigation*.

<sup>5</sup> *The Complete Works of Alfred Tennyson* for OUP, General Edited by Michael J Sullivan with Advisory General Editor Catherine Phillips.

<sup>6</sup> On how literary criticism and theory can take account of digital editions, see, for example, Elena Pierazzo, 'Digital Genetic Editions: The Encoding of Time in Manuscript Transcription', in Marilyn Deegan and Kathryn Sutherland (eds), *Text Editing, Print, and the Digital World* (Farnham, 2009), 169–86.

<sup>7</sup> See Gameson, Beeby, Fiorillo, Nicholson, Ricciardi, and Reynolds, *The Pigments of British Medieval Illuminators*, 1–41. On uses of X-Ray Fluorescence, see also, for example, Anne Michelin, Fabien Pottier and Christine Andraud, '2D macro-XRF to reveal redacted sections of French queen Marie-Antoinette secret correspondence with Swedish count Axel von Fersen', *Science Advances*, 7 (2021), 1–9 <<https://doi.org/10.1126/sciadv.abg4266>>.

<sup>8</sup> Our portable Multispectral Imaging system comprises a modified DSLR camera, equipped with an achromatic lens, 12 interference filters allowing imaging across the range 365–1050 nm, and selections of 365, 400, 450–650, 700, 750, and 825–1050 nm LED illumination. Since the angle at which light refracts through glass varies by wavelength and multispectral imaging uses a wide range of wavelengths, achromatic and apochromatic lenses (see also n. 9 below) are 'corrected' to maintain sharpness over the full range of the imaged spectrum. FORS spectroscopy recorded in the range 400–2500 nm using a bespoke spectrometer as described in Beeby et al., 'There's more to reflectance spectroscopy than lux', 144–7.

<sup>9</sup> Sullivan equipment: infrared microscope. University Library, Cambridge: Megavision E7 with hyper-spectral UV-IR apochromatic lens.



between. Optical filters placed between the manuscript and the camera lens control the colours or wavelengths of light that reach the camera, while additional LED banks control the precise wavelengths illuminating the manuscript.<sup>10</sup> As well as recording reflectance images, these instruments enable the application of further techniques, such as fluorescence (where the page is illuminated at shorter wavelengths, causing it to emit light or ‘glow’ at longer wavelengths), transillumination (where light is shone through the reverse of the folio while it is being imaged) and raked lighting (where light is cast across the surface of the page at a sharp angle, throwing into relief the texture of both page and ink). By imaging a stationary manuscript folio with up to 49 combinations of these variables, we reach a breadth of imaging that draws out details well beyond the normal visual range of the naked eye. Digital processing then allows us to combine versions of these images, minimizing some markings on the page while enhancing others that had been hidden.

Some results appear immediately when seen under a specific wavelength of light, without the need for further processing. For others, image processing continues this work through assembling combinations of these raw images into ‘data cubes’, so called because their layering of many images enables differences between the wavelengths to be analysed at the level of each pixel. The cube’s image data can then be reorganized to accentuate, minimize, or even separate statistical trends in regions of interest, at times drawing out writing that had been lurking beyond the reach of the human eye. A combination of methods including data cube transformations, false-colour images, and High Dynamic Range (HDR) Toning—each performed by Sullivan and Easton—combines with software designed at Rochester Institute of Technology.<sup>11</sup> Several of these processes exploit slight colour differences in images by pushing their colours further away from each other in order to accentuate them (digital decorrelation stretching). While some results are viewable in the raw images alone, for others the images presented below are the result of many hours of painstaking processing. The immediate literary application is to glimpse details that would not be readable or even detectable through the normal visual spectrum.

### CRITICAL IMPLICATIONS

Literary criticism and the study of material texts are two major fields to benefit from these findings. The most immediately consequential implications of this work, for example, relate to the act of poetic revision. The reasons why revision is so central to multispectral imaging revolve around the fascinating fact that nineteenth-century gallotannic (‘iron gall’) ink becomes virtually transparent when viewed under near-infrared light (> 850 nm).<sup>12</sup> Using FORS, which produces a reflectance spectrum of the ink, and X-ray fluorescence, which identifies elements in the ink composition and particularly the heavier metallic elements such as iron, copper and zinc, we have confirmed that the samples of Tennyson’s ink recorded were undoubtedly iron gall. Such FORS and XRF analysis chimes with the observations in the multispectral imaging and earlier pilot work by Sullivan with a portable near-infrared microscope, which images the page at > 800 nm. Imaged in this way, Tennyson’s iron gall inks become transparent under near-infrared light, whereas carbon or graphite inks stay opaque.

Authenticating manuscripts is one important application of this finding; a supposed nineteenth-century ink that is not rendered transparent under near-infrared illumination is highly unlikely to be an authentic iron gall ink and should therefore, we propose, prompt further investigation for the possibility of forgery. A further application is distinguishing between an

<sup>10</sup> ‘Optical’, ‘interference’, or ‘bandpass’ filters allow some colours of light to pass while blocking others, enabling precision of colour isolation.

<sup>11</sup> Some scripts designed and implemented by Roger Easton Jr; use of Hoku and Adobe Creative Cloud by Michael J Sullivan.

<sup>12</sup> Agata Klos, ‘Non-invasive methods in the identification of selected writing fluids from the late 19<sup>th</sup> and early 20<sup>th</sup> century’, *Conservation, Exposition, Restauration, d’Objets d’Art: Revue Électronique*, 4 (2014) <<https://doi.org/10.4000/ceroart.3950>>.

author's manuscript annotation of printed books—the marking of lines down margins of interesting passages, for example—and printed lines from badly inked plates of type arising in the printing process. Tennyson's library contains examples where ink marks appear by passages of text, lines that could be the author's or the printing plate's. The difference is of clear consequence for literary criticism, for one represents the literal creative engagement of one author with the works of another—the records of Tennyson's intellect at work; the other is an accident of the printing process. Literary criticism's perennial interest in manuscript cultures, combined with D. F. McKenzie and Jerome McGann's foundational understanding of the sociology of the text,<sup>13</sup> have given rise to the study of annotation itself as having an important bearing on intellectual history. From Stephen Orgel's *The Reader in the Book: A Study of Spaces and Traces* (2017), for the early modern period, to Andrew Stauffer's *Book Traces* (2021) for the Romantics and Dirk Van Hulle's recent work on the library of Samuel Beckett (2013–), the distinction between reading mark and printing blemish matters for the current material turn in literary studies.<sup>14</sup> Sullivan has already established some such lines in the Tennyson Research Centre at Lincoln that do not become faint when viewed under near-infrared.<sup>15</sup> Combined with other ink stains elsewhere in the same volume, this method has enabled Sullivan to establish that certain lines were not Tennyson's but arose from the printing plate: a guard for literary critics and scholars against mistaken authorial intention.

Yet the consequences of this infrared effect on iron gall ink are far more wide-reaching and require multispectral or hyperspectral imaging to see fully. When authorial revision occurs after the first draft—that is, when the author returns to a page in order to revise it—it is common for the ink to have a different iron content. Reaching the bottom of the ink well, diluting inks to make them go further, even mixing one's own inks, can result in differences visible under infrared. Use of 200x microscopy at the Houghton Library, Harvard, and the University Library, Cambridge, has discovered instances where Tennyson's ink appears to have an unusually high ratio of binding agent to pigment, perhaps to make the ink go further.<sup>16</sup> Under the naked eye, this can create a 'halo effect' around the letters, especially for manuscript revisions written into printed books, where the publisher has chosen the paper for printers' ink, affecting the absorption of the author's own amendments. Near-infrared imaging in particular can reveal separate stages of revision by throwing the stages of text further into their different pigments, as some inks appear fainter than others owing to differences in their chemical composition and application on the page. In a folio once filled with solid literary text, the original stage of writing, for example, can be sent to a fainter outline, rendering the revisions immediately visible. The observation allows a further distinction to be made between textual revision that has been performed immediately in the white heat of composition, and that returned to after the fact—recollected in tranquillity, to adapt Wordsworth's 1800 'Preface to *Lyrical Ballads*'.<sup>17</sup>

## RECOVERING GHOST TEXTS

Distinguishing minute differences in ink pigments through multispectral imaging has major editorial and critical implications. It opens up the possibility that ink blots can be digitally 'stripped

<sup>13</sup> Jerome J. McGann, *The Textual Condition* (Princeton, NJ, 1991).

<sup>14</sup> Stephen Orgel, *The Reader in the Book: A Study of Spaces and Traces* (Oxford, 2015); Andrew Stauffer, *Book Traces: Nineteenth-Century Readers and the Future of the Library* (Philadelphia, PA, 2021); Dirk Van Hulle, *Samuel Beckett's Library* (Cambridge, 2013); see also Jason Scott-Warren, 'Unannotating Spenser', in Helen Smith and Louise Wilson (eds), *Renaissance Paratexts* (Cambridge, 2011), 153–64.

<sup>15</sup> See, for example, Lincoln, Tennyson Research Centre, TRC/AT/1288, Immanuel Kant, *Prolegomena to Every Future Metaphysic which can Appear as Science*, tr. John Richardson (London, 1819), 17.

<sup>16</sup> We are grateful to Leslie Morris and to Debora Mayer, Harvard's Senior Paper Conservator, for examining this ink with Sullivan.

<sup>17</sup> William Wordsworth, 'Preface to *Lyrical Ballads, with Pastoral and Other Poems* (1800 and 1802)', in William Wordsworth, ed. Stephen Gill (Oxford, 2010), 73; see also Dirk Van Hulle, *Modern Manuscripts: The Extended Mind and Creative Undoing from Darwin to Beckett and Beyond* (London, 2014), 63–4.

away' to reveal non-invasively the text beneath. In the right circumstances, lost literary draft text may therefore be recovered, retrieving traces of the author's creative process. Few works effect such transformations in their fields as the scholarly editions that include these variants: the authoritatively unearthed and intricately annotated lines of poets and novelists, philosophers and musicians, which together form the bedrock of humanistic enquiry. For the literary texts on which scholarship builds its foundations are often as firm as shifting sands, revised, transcribed, and modernized by many authorial and scribal hands. Editions of modern English and Anglophone poets, from Tennyson to Elizabeth Bishop, have rarely found a way to represent the full creative development of literary works, as changing and competing versions pull against the printed word's illusion of finality.<sup>18</sup> Even for those editions that print each draft state of a work successively, as if every change represents a new work of art,<sup>19</sup> aspects of first drafts have remained until recently simply denied to the modern reader. We refer here not to drafts that were destroyed or lost, but to those traces of thought and expression that remain present but undecipherable: the words of literary drafts that were blotted, deleted, or crossed out in ways that have rendered an artwork merely an unreadable artifact.<sup>20</sup>

The results of this spectral imaging can be revelatory, as with this moment from Tennyson's 'Lancelot and Elaine', one of the *Idylls of the King* and written here on laid ultramarine paper. No previous edition has printed this version, but the below processed image now confirms the reading:

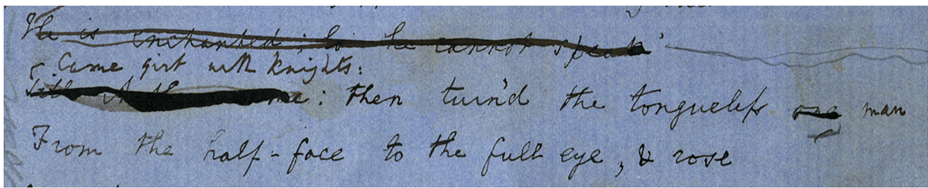


FIG. 1. Wren Library conventional digitization of O.15.39.2, f. 49<sup>r</sup>. Reproduced by kind permission of the Master and Fellows of Trinity College, Cambridge.

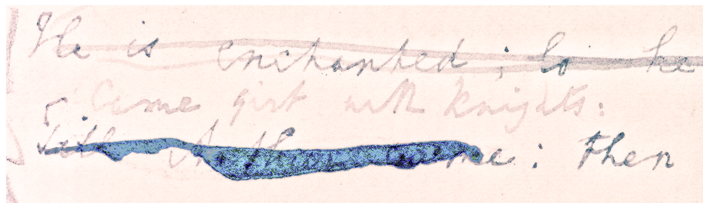


FIG. 2. Processed multispectral image of Wren Library, O.15.39.2, f. 49<sup>r</sup>. Processed by Michael J Sullivan and imaged by Andrew Beeby. Reproduced by kind permission of the Master and Fellows of Trinity College, Cambridge.

<sup>18</sup> Michael J Sullivan, 'Dickinson's Voice', review of Cristanne Miller, ed., *Emily Dickinson's Poems: As She Preserved Them* (Cambridge, MA, 2016), in *Essays in Criticism*, 69 (2019), 108.

<sup>19</sup> See, for example, *The Poems of Emily Dickinson*, ed. R. W. Franklin, 3 vols (Cambridge, MA, 1998). On Dickinson's editions, see Sullivan, 'Dickinson's Voice', 103–9.

<sup>20</sup> On lyric poetry as caught between effusion and artifact, see Jonathan Culler, *Theory of the Lyric* (Cambridge, MA, 2017), 115.

The top line of Fig. 1 is from the official digitization of the Wren Library, where there are clearly different orders of challenge to the literary critic. The deletion of 'oar' at the right-most margin is discernible, and in the first line a conjectural reading might immediately be ventured: 'He is enchanted; [lo?] he cannot speak.'<sup>21</sup> The central blot is more troublesome. 'Till' is probable though not certain in this digitization, but is slightly clearer when examined in person. Through multispectral imaging and processing, however, we can unmask the full variant: 'Till Arthur came'. The restored words reveal Tennyson's drafting of a longer and pivotal episode in 'Lancelot and Elaine' where the recently departed body of Elaine, the 'lily maid of Astolat', is brought by boat and a voiceless 'oarsman' into Camelot bearing a letter for the court.<sup>22</sup> As often in Tennyson's embellishments of his Arthurian sources, through folly or fear the court interprets in those natural events a supernatural cause—for on the facing folio and in the published editions, the manuscript's line is shortened to 'He is enchanted, cannot speak', while referring to Elaine as 'the Fairy Queen' and connecting her to the rumour of King Arthur's immortality: 'For some do hold our Arthur cannot die, / But that he passes into fairy land.'<sup>23</sup> In manuscript as in print, the episode layers superstition with hearsay, the wrongheaded conclusions satirizing even as they marvel at the scene's splendour 'Till Arthur came'.<sup>24</sup> That the manuscript elevates its first version of Arthur's arrival from factual statement into idolizing grandeur ('the King / Came girt with knights')<sup>25</sup> is central to the wider danger that runs through the *Idylls*: the danger of complete enchantment, from Merlin's beguiling by Vivien, bringing about his demise, to the unhesitating following of leadership that a chivalric code might entail. These revisions enact a shift to the dramatic and indeed to the overly dramatic: from wrought to overwrought. That shift from 'Till Arthur came' to 'Came girt with knights' might also exhibit the very kinds of overwrought heightening of language that would later be criticized in early reviews of the *Idylls of the King*.<sup>26</sup> This newly visible process of composition reveals its over-dramatic quality, in this line at least, to be an addition: one that enhanced the dramatization of Camelot's own flawed state. Each occurs under the sign of an Arthurian mythology that we know will end in the death of Arthur, the decline of a kingdom, and the loss with which Thomas Malory's version concludes.

The full confirmation of this text took two phases of imaging with different lighting effects, and processing those combinations for complete readability involved a sequence of trial and adaptation to determine the best methods. Different characters were enhanced in an array of raw multispectral images without processing, blended and reorganized as a data cube to show the final result. Among the techniques used were infrared, UV raked lighting, and UV fluorescence during a second examination of the manuscripts. When processing the most promising images in the data cube, the striking contrast of Fig. 2 unlocks—a variant included in no prior edition.

Further examples include the following passage from *The Princess*, where collaboration between Sullivan and Easton has confirmed fully the line underneath the deletion. What is remarkable as a test case for these processing techniques is how they can send differences in ink

<sup>21</sup> Cambridge, Wren Library, O.15.39.2, f. 49<sup>r</sup>.

<sup>22</sup> Alfred Tennyson, 'Lancelot and Elaine', ll. 1232–318, in *The Poems of Tennyson in Three Volumes*, ed. Christopher Ricks, 3 vols (London, 1987), 3. 456–9. See also the reproduction of the manuscript folio in Christopher Ricks and Aidan Day (eds), *The Tennyson Archive*, vol. 15: *Tennyson: The Manuscripts at Trinity College Cambridge* (New York, NY, 1988), 207. On the wider context of Tennyson's revisions to *Idylls of the King*, see Sally Bushell, *Text as Process: Creative Composition in Wordsworth, Tennyson, and Dickinson* (Charlottesville, VA, 2009), 117–67; Herbert F. Tucker, 'Better Yet: Tennyson's Poetic Revisionism in the Harvard Manuscripts', in Daniel Tyler (ed.), *Poetry in the Making: Creativity and Composition in Victorian Poetic Drafts* (Oxford, 2020), 54–64. On the literary-critical analysis of manuscript revision for the study of verse forms, see Michael J Sullivan, 'Sesta Rima as a Mode of Imitation: Hybrid Forms in Anglo-Italian Verse', *RES*, 74 (2023), 829–42.

<sup>23</sup> See the first published edition of this passage: 'Elaine', ll. 1246 and 1250–51, in Alfred Tennyson, *Idylls of the King* (London, 1859), 212–13; for the wider passage (also without the variant 'Till Arthur came'), see Alfred Tennyson, *A Variorum Edition of Tennyson's Idylls of the King*, ed. John Pfordresher (New York, NY, 1973), 708–10. See also further revision on the facing verso: Cambridge, Wren Library, O.15.39.2, f. 48<sup>r</sup>.

<sup>24</sup> Cambridge, Wren Library, O.15.39.2, f. 49<sup>r</sup>.

<sup>25</sup> See Tennyson, *Idylls of the King* (London, 1859), 213.

<sup>26</sup> See Walter Bagehot's review of *Idylls of the King*, in *National Review*, 9 (1859), 368–94, quoted in *Tennyson: The Critical Heritage*, ed. John D. Jump (London, 1967), 230–31.



pigment between the two stages of revision to radically distinct extremes, letting us comfortably read under the cancellation. For all its artistic importance, the variant of *The Princess* appears in no previous edition—an image but not a transcription is printed in the Garland *Tennyson Archive* facsimile series, in a printing that accentuates the weight of the erasure.<sup>27</sup> The ‘underwriting’ is here pictured and fully confirmed in two processed multispectral images (Figs. 3 and 4):

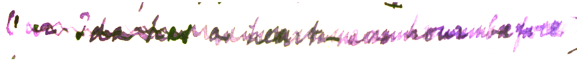


FIG. 3. Processed multispectral image of lines from *The Princess* VI, Cambridge University Library, detail from MS Add. 6345, f. 86<sup>r</sup>. Processed by Roger Easton Jr and Michael J Sullivan; Megavision digitization by Cambridge University Library. Reproduced by kind permission of the Syndics of Cambridge University Library.

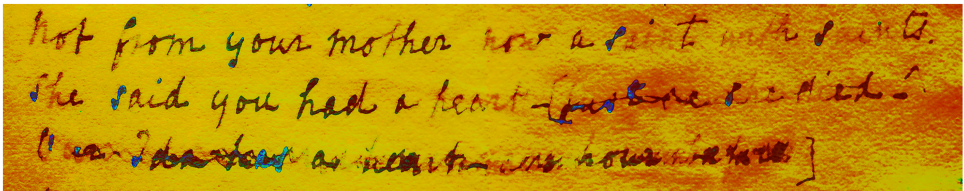


FIG. 4. Processed multispectral image of lines from *The Princess* VI, Cambridge University Library, detail from MS Add. 6345, f. 86<sup>r</sup>. Processed by Roger Easton Jr and Michael J Sullivan; Megavision digitization by Cambridge University Library. Reproduced by kind permission of the Syndics of Cambridge University Library.

Not from your mother now a saint with saints.  
 She said you had a heart – [just ere she died. ^  
 Our Ida has a heart—an hour before]<sup>28</sup>

Of clear significance is the wider applicability of this technique; for while this variant can be guessed from scrutiny of the original manuscript, multispectral processing yields an unequivocal reading of an illuminating line for the development of character in the poem. The draft moment, from Section VI, addresses the poem’s eponymous Princess Ida (‘you’) and recovers a thread in Tennyson’s artistry as he considered alternative characterizations in this passage. Read in its full context, the deleted line splinters into the following artistic alternatives: ‘She [your mother] said you had a heart – just ere she died’ and ‘She said “Our Ida has a heart” – an hour before she died’. What the deletion removes is a heavier characterization of a mother judging her daughter to have a heart only on her deathbed as her own heart softens, and lost at first in that deletion is a further latent questioning of whose heart might be lacking. By the first edition, in 1847, Tennyson would restore the version ‘just ere she died’, but in cancelling the more specific phrase ‘an hour before’ he also dropped a syllable and prosodic beat.<sup>29</sup> The revision reveals how Tennyson ceased to draft the line ‘an hour before’ at the moment it reaches its apportioned blank verse length, such that the next two syllables, ‘she died’, would have tipped the line into an alexandrine. As the

<sup>27</sup> Christopher Ricks and Aidan Day (eds), *The Tennyson Archive*, vol. 26: *Tennyson: The Manuscripts at the University Library*, Cambridge (New York, NY, 1991), 195.

<sup>28</sup> Cambridge, University Library, MS Add. 6345, f. 86<sup>r</sup>.

<sup>29</sup> The corresponding published version is reprinted in Section VI of *The Princess*: see *The Poems of Tennyson in Three Volumes*, 2. 274. See also Cambridge, University Library, MS Add. 6345, f. 85<sup>v</sup>.

variant demonstrates, the timing of the mother's death and the timing of the verse's metres were intricately interwoven in the act of revision.

Other applications confirm for certain some of editing's more marginal calls. As figures from Christopher Ricks to Kathryn Sutherland have exemplified, the editor and the critic are often the same person, editing itself being a form of literary criticism. For the purely literary-critical task, nonetheless, a guess at a line may be sufficient to enable a wider critical argument, and the careful critic may simply mark which words of the transcription are conjectural. The scholar entering their editorial mode, however, might agonize more deeply, seeking to reach the final reading that can be authorized in the printed or digital edition. Raked lighting, performed by torch or fixed installation, can help to highlight changes in texture that can increase readability. Reproduction, whether through digital scans, high-resolution photography, microfilm, or photocopies, can surprise with unexpected emphases, perspectives, or scales. Rarely, scholars have used infrared illumination to seek a definitive reading. The potential of near-infrared wavelengths in particular was a phenomenon that interested Norman MacKenzie, who trialled the use of infrared light and interference filters in his preparation of the text of Hopkins. Degradation of the equipment, as MacKenzie observed, and the absence of digital post-processing unfortunately limited the wider application of that first experiment in literary infrared analysis.<sup>30</sup> More routinely, transillumination—through torchlight, sunlight (holding the manuscript to a window), or even an LED lightbed—can help to settle some difficult lines. Combining many of these methods, the sheer range of processing options available to multispectral imaging is at once a synthesis of these editorial technologies and an extension into new digital terrain.

Take the following lines of the poem '1865–1866', pictured here in the authorized digitization by the Wren Library.<sup>31</sup> Improvement in visibility is already possible through a conventional digitization using excellent lighting conditions and raw image development. But confirmation of the line comes swiftly and unequivocally in the form of multispectral imaging, followed by further processing (Fig. 6). The difference in the below images is between deducing the full reading and seeing it—between inference and complete, unequivocal reading:

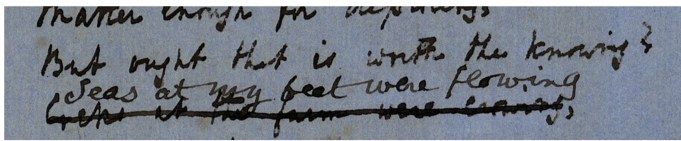


FIG. 5. Wren Library conventional digitization of Tennyson Notebook O.15.33, f. 1<sup>r</sup>. Reproduced by kind permission of the Master and Fellows of Trinity College, Cambridge.

<sup>30</sup> Norman H. MacKenzie, 'Introduction', in *The Later Poetic Manuscripts of Gerard Manley Hopkins: In Facsimile*, ed. Norman H. MacKenzie (New York, NY, 1991), 11; *The Poetical Works of Gerard Manley Hopkins*, ed. Norman H. MacKenzie (Oxford, 1990), xxxix–xliii.

<sup>31</sup> The photograph is included in the Cambridge Digital Library, *Lucretius. The Victim (Trinity College O. 15. 33), f. 1<sup>r</sup>* <<http://cudl.lib.cam.ac.uk/view/MS-O-00015-00033/2>>; see also an earlier facsimile reproduction in Christopher Ricks and Aidan Day (eds), *The Tennyson Archive*, vol. 14: *Tennyson: The Manuscripts at Trinity College Cambridge* (New York, NY, 1988), 227.



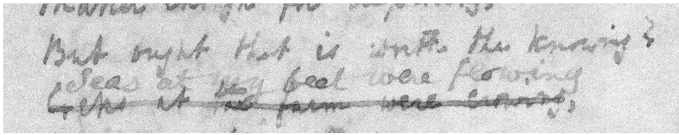


FIG. 6. Processed Multispectral image of O.15.33, f. 1<sup>r</sup>. Imaged by Andrew Beeby and processed by Roger Easton Jr. Reproduced by kind permission of the Master and Fellows of Trinity College, Cambridge.

What the imaging allows is an unambiguous reading of the variant ‘Cocks at the farm were crowing’, cancelled and replaced with ‘Seas at my feet were flowing’, as pastoral is reconfigured into landscape, an image of the speaker’s feet lapped by the waves.<sup>32</sup> The lines show Tennyson torn between two motifs that run throughout his manuscripts, gathering pace through his creative process: the appeal to bird shrieks and birdsong on the one hand as a metaphor for verse—and the invocation of the sea that for Tennyson would represent the final Arthurian voyage to another land beyond life: the echoing of song from an origin across the waters, and the subject of his ‘Crossing the Bar’. That later poem revolves around its conceit of the sea as journey to an afterlife, ‘When that which drew from out the boundless deep / Turns again home’,<sup>33</sup> where the former line borrows a beat from the latter, as the ebbs and flows of lineation render an emotion kept barely under control.

These are the metrical effects of Tennyson’s artistic training, glimpsed also in the above-imaged manuscript at the Wren Library, in which the draft line shows how prosodic experimentation relates to the thematic development of the poem (Fig. 6). Both of those lines—‘Seas at my feet were flowing’ and ‘Cocks at the farm were crowing’—are, curiously, of three pulses and seven syllables.<sup>34</sup> Whether we wish to read for feet, beats,<sup>35</sup> or only syllables, however, what is especially significant is the revision from ‘flowing’ to ‘crowing’, where in both instances the metrically unstressed line-end pulls the line over into its seventh syllable, a phenomenon familiar to Italianate verse as well as to Byron’s Italianate rhymes that the young Tennyson had self-consciously imitated.<sup>36</sup> Years earlier, Tennyson had used similar lines in ‘The Ballad of Oriana’ and the Conclusion to ‘The May-Queen’,<sup>37</sup> and the above-pictured variant is one of the many phrases that echoed through Tennyson’s auditory imagination. The revision further demonstrates how Tennyson’s revisions to line ends frequently negotiate the tension between conceptual modulation and aural anchoring in their existing rhymes.

When imaging such erasures, the approaches that found the most success were not only using infrared but a combination of infrared and UV-induced fluorescence. Under the latter, fluorescing blots can appear on the page—most likely candlewax residue—the literal traces and scars of the circumstances of material composition, circulation, and reading.<sup>38</sup> These insights

<sup>32</sup> This processed image of the poem ‘1865–1866’ confirms the earlier presumed reading in *The Poems of Tennyson in Three Volumes*, 2. 691.

<sup>33</sup> Alfred Tennyson, *Demeter and Other Poems*, vol. 7: *The Works of Alfred Lord Tennyson* (the Eversley Edition), ed. Hallam Tennyson (London, 1908), 193.

<sup>34</sup> Scanned as accentual-syllabic metre, both conform to a trochaic substitution followed by two iambs and a hypermetrical unstressed syllable, even as ‘Seas at my’ and ‘Cocks at the’ tend in spoken reading towards the dactylic.

<sup>35</sup> On metrical beats, see Derek Attridge, *The Rhythms of English Poetry* (London, 1982); Derek Attridge, *Poetic Rhythm: An Introduction* (Cambridge, 1995).

<sup>36</sup> Sullivan, ‘Sesta Rima as a Mode of Imitation’, 11–14.

<sup>37</sup> See ‘New-Year’s Eve’ in ‘The May Queen’ (‘Before the red cock crows from the farm upon the hill’, l. 23), ‘The Ballad of Oriana’ (‘At midnight the cock was crowing, [...] Winds were blowing, waters flowing’, ll. 12–14), and ‘The Revival’ from *The Day-Dream* (‘And barking dogs, and crowing cocks’, l. 4), in *The Poems of Tennyson in Three Volumes*, 1. 458, 271; 2. 54.

<sup>38</sup> See the lower portion of Cambridge, Wren Library, O.15.39.2, f. 49<sup>r</sup>.

open up new paths for the formal study of literary manuscripts—the close reading of drafts—but also for those interested in the materiality of texts and the ongoing challenges of their preservation.

## PRESERVING MATERIAL CULTURE

Among the critical consequences of these digital techniques is a further window into creative process in modern manuscript cultures, as well as increased insight into the state and preservation of literary collections. The sobering reality is that iron gall ink can be corrosive.<sup>39</sup> Even as this project develops new techniques to recover draft lines and the circumstances of composition, it does so with a countdown. In places, Tennyson's ink has already started to corrode both his words and paper. As medieval and ancient manuscripts further confirm, the corrosion of iron gall ink can move towards the eventual loss of the cultural materials it created: the medium of the original artwork then ends in self-destruction. In its entirety, such a process takes centuries and its progress can be highly variable. However, in the question of ink blots, what is at stake are minute differences in pigment and texture that might still allow us to bring back 'underwriting' obscured by blots, erasures, and environmental damage. As this article has established, the draft lines from Tennyson in need of recovery are so finely differentiated in pigment, so subtle in their palaeographical considerations, that the best time to recover such precise gradients of detail is as soon as the technology is available, before any details and draft lines are pushed beyond the limit of recovery.

This issue could not be more relevant for Tennyson's notebook for *The Princess*, where many draft parts of lines have already been lost to the reader's eye. What follows, then, is an analysis and at times recovery of draft letters at the very limits of what is currently possible: the many draft lines in a water-damaged notebook of Tennyson's long and pivotal poem, *The Princess*, written and revised over more than a decade and first published in 1847. The notebook in question lies at the University Library at Cambridge, MS Add. 6345, photographs of which appear without transcription in the Garland facsimile series, which remains the most recent reproduction of the full notebook.<sup>40</sup> Numerous lines in this notebook have been damaged, either from water shock or damp, which have faded lines on many folia to a tantalizing extent. To the reader's eye, it appears as if there is text hiding within the staining just beyond reach, though finding the best way to restore such text is fraught with difficulty. Other features of the text, including stages of revision and ink pigments, are separated by infrared light, but the major challenge to restoring these water-damaged draft lines has been a waxy texture to some of the folia. Whether the waxy texture results from the original damage to the page or from later attempts at conservation remains unclear. The shading of the water damage and the ink pigment are so close, furthermore, that many processing scripts have reduced rather than increased the contrast between these two pigments; in short, the water damage may have washed the pigment into the paper, creating a test case for the potential of this technology to restore water-damaged text.

Such is the case on the following water-damaged folio from Section VI of *The Princess*, where the multispectral imaging restores characters that had been lost (Fig. 7):

<sup>39</sup> Joanna Kosek and Caroline Barry, 'Investigating the Condition of Iron Gall Ink Drawings: Developing an Assessment Survey', *Journal of the Institute of Conservation*, 42 (2019), 191–209.

<sup>40</sup> Cambridge, University Library, MS Add. 6345, which is reproduced in *Tennyson: The Manuscripts at the University Library*, 65–241.

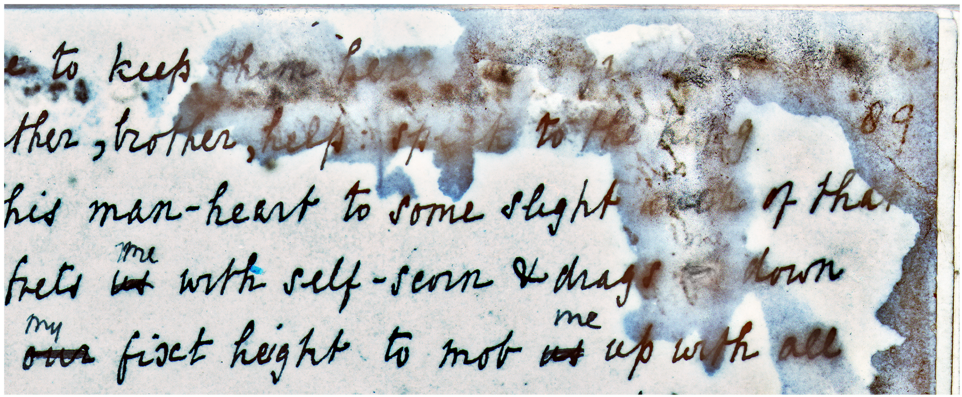


FIG. 7. Processed multispectral image of lines from *The Princess* VI, Cambridge University Library, detail from MS Add. 6345, f. 89<sup>r</sup>. Processed by Michael J Sullivan and imaged by Andrew Beeby & Michael J Sullivan. Reproduced by kind permission of the Syndics of Cambridge University Library.

The processed image restores characters that had previously been unreadable and for others increases readability further. Among the most striking proofs of concept in this folio is the above-imaged word 'grant' in the first line. Differently punctuated to the first edition, that line shares much with the first edition's line 'What use to keep them here, now? grant my prayer',<sup>41</sup> where the heavily washed-out 'grant', the 'er' in 'prayer', and descending letters consistent with the 'p' and 'y' in prayer are each visible in Fig. 7.<sup>42</sup> Further revisions relate to the poem's wider navigation of individualism and collective identities. In revision, Tennyson arrived at the faded section of the fourth line, 'drags me down' (the version that stands in the first edition), but only after displacing the collective pronoun of 'us' with the individual 'me'. The phrase 'my prayer' similarly emerged through revision, with an additional cancelled word (potentially 'our' in some processed images) replaced with the word 'my'. These pronoun changes connect with others in the manuscript passage, including the change from 'frets us' to 'frets me with self-scorn', from 'our fixt height' to 'my fixt height', and 'mob us' to 'mob me',<sup>43</sup> accentuating the tension that runs through *The Princess* between the social and the self. Between the manuscript and the printed editions, Tennyson changed the speaker's phrasing of the third and fourth pictured lines, dropping the word 'slight' to keep the line a regular decasyllabic blank verse.<sup>44</sup> No edition has yet printed these revisions, and they are published here for the first time.

When diving deeper into this passage, further tantalizing shapes in the stain's patina hint at the potential of additional palimpsestic writing: writing that has been erased or overwritten. Not least is the question of whether the stained areas may suggest traces of text running from top to bottom. Some of these shapes are suggested when magnifying the area running from 'prayer' to the folio number; others arise when enlarging the right-hand edge of the folio, and still more characters may have been written across the cascading edges of the folia behind 89<sup>r</sup>. Curiously, some ink appears to cascade over edges of multiple folia in their current binding, even though the pattern of water damage is different on adjacently numbered folia, displaying signs of a previous order.<sup>45</sup> Take folio 27<sup>r</sup>, for example, the top of which also appears to contain marginal text.

<sup>41</sup> For the printed line, see Section VI of *The Princess*, l. 285, in *The Poems of Tennyson in Three Volumes*, 2. 276.

<sup>42</sup> Cambridge, University Library, MS Add. 6345, f. 89<sup>r</sup>.

<sup>43</sup> Cambridge, University Library, MS Add. 6345, f. 89<sup>r</sup>.

<sup>44</sup> Alfred Tennyson, *The Princess: A Medley* (London, 1847), 136.

<sup>45</sup> With thanks to Marina Pelissari, Book and Paper Conservator at the University Library, on the irregularity of the damage.

Figure 8 presents lines of 27<sup>r</sup> from Section II of *The Princess*, in a composite image that blends several processing methods, drawing out a further range of detail than appears in one image alone:

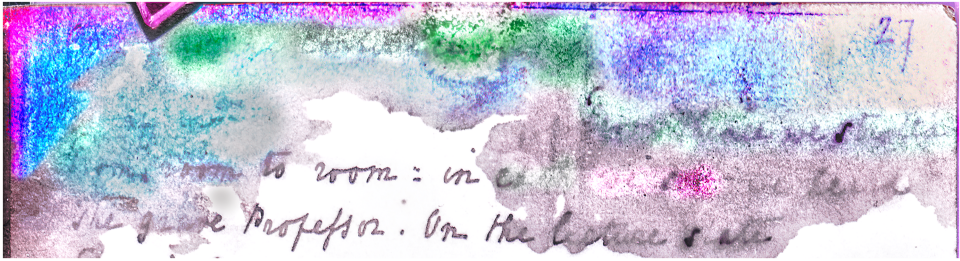


FIG. 8. Composite processed multispectral image of lines from *The Princess* II, Cambridge University Library, detail from MS Add. 6345, f. 27<sup>r</sup>. Processed by Michael J Sullivan; Megavision digitization by Cambridge University Library. Reproduced by kind permission of the Syndics of Cambridge University Library.

Within the folio's upper section emerges the remains of an earlier variant of the poem's printed line from Section II, 'And thus our conference closed', the last words of which are faintly readable in the processed images.<sup>46</sup> What completes that blank verse line is an indented line of text below, a variant form of the first edition's text:

From thence we stroll'd  
From room to room: in [each?] we sat we heard  
The grave Professor. On the lecture slate<sup>47</sup>

For the printed editions, 'From thence' was later simplified and temporalized to 'And then', and on loose revision pages turning the 1848 second edition into the 1850 third edition Tennyson's handwriting deepens the complexity of visual description: 'And then we stroll'd / For half the day thro' stately theatres / ~~From room to room:~~ Bench'd crescent-wise: in each we sat, we heard / The grave Professor.'<sup>48</sup> The textual stages record the ways in which plot description and visibility accumulate in layers of revision. Even the top of the folio had itself been subject to revisions: above the phrase 'conference closed' appears the remnants of a superscript revision in small size, suggesting a later addition squeezed into the remaining space. The very top of the folio hints at a ruled line and text,<sup>49</sup> while magnifying the upper right of the image suggests the presence of additional characters within the patina.<sup>50</sup> Such glimpses of faint characters at the limits of physical recovery open up the potential of digital manuscript processing as a frontier of digital editing.

<sup>46</sup> Alfred Tennyson, *The Princess: A Medley* (London, 1847), 41.

<sup>47</sup> Cambridge, University Library, MS Add. 6345, f. 27<sup>r</sup>.

<sup>48</sup> Lincoln, Tennyson Research Centre, TRC/AT/4224, P178F, 'The Princess 1848 for 1850 ed'; Alfred Tennyson, *The Princess: A Medley*, 3<sup>rd</sup> edn (London, 1850), 45.

<sup>49</sup> UV microscopy under 395 nm illumination initially confirmed the presence of some distinct ink markings suggested by visual examination of the manuscript.

<sup>50</sup> In a number of processed images, it is also possible to see the imprint of the 'machine wire' from the manufacturing process of the paper, a feature historically seen through beta-radiograph: see Philip Gaskell, *A New Introduction to Bibliography* (Oxford, 1974), 225.



Whether in recovering text or in confirming it, digital processing of multispectral bands can significantly improve water-damaged line fragments compared with conventional digital imaging. Combinations of bands with UV-induced fluorescence have on the whole offered most promise for water-damaged lines, at times illuminating just enough washed-out characters in water-damaged iron gall ink to confirm a manuscript line. Other folia in the notebook are now undergoing further processing to draw out lost details, and for those where there is still ink pigment left the effect would be transformative for the textual understanding of this poem. The quest to recover such variants has already revealed aspects of the materiality of *The Princess* notebook, of use not purely to formal literary criticism but to material culture and history. In this notebook and another at the Wren Library, additional processing techniques enhance bleedthrough of text from the other side of the folio,<sup>51</sup> allowing for the possibility in our ongoing research of recovering text using the reverse of a folio or the indentation left by the pen nib (Fig. 9):

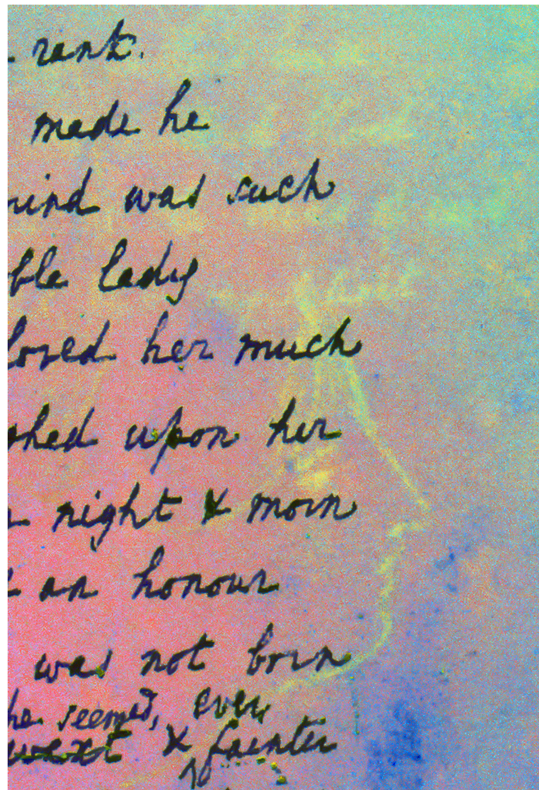


FIG. 9. Processed multispectral image of Tennyson Notebook 'X', Wren Library, Cambridge O.15.17, f. 56<sup>r</sup>. Processed by Roger Easton Jr and imaged by Andrew Beeby. Reproduced by kind permission of the Master and Fellows of Trinity College, Cambridge.

Such a technique suggests that where folia have been glued together and where separating the folia would risk damaging them, this kind of imaging may be a more practical alternative to

<sup>51</sup> Wren Library, O.15.17, f. 56<sup>r</sup>.

the X-ray imaging that may otherwise be needed to recover the encased text. By contrast, only multispectral imaging and these processing techniques are needed to enhance this dramatic bleedthrough, seen in Fig. 9. What bleeds through is not only ghost text from the verso,<sup>52</sup> but also ghostly faces, traces of Tennyson's sketching from the other side of the manuscript, the material traces of his visual imagination.

## GHOST TEXTS AND THE DIGITAL HUMANIST

Digital humanities and digital editing are bringing about a new age for the study of literature, for they not only present additional methods in criticism but offer to expand the corpus of available texts. Repeatedly, the examples and methods in this article demonstrate how the most microscopic of details—whether they be material or metrical—can be of widespread significance.<sup>53</sup> A recovered variant is not only a new version, but sheds light on what we understand as an author's work, their development, their creative process, and the relations between draft lines in one work and their resurfacing in another. How an author writes, in what materials, and the ends on which their creative process converges, are matters at the heart of the study of literature as at once form and idea, a relic and record of the material conduits through which ideas spread in writers' circles.<sup>54</sup> Fresh insights into Tennyson's manuscripts and inks, moreover, allow us to establish benchmarks for verifying new manuscripts of his poems, while aspects of his compositional process illuminated through his inks and writing paper enhance how we understand the material consequences of his changing practices and shifts in his reputation.

The present study proves these techniques are viable and offers a theorization of how these methods can enhance rather than compete with the long-held touchstones of literary methods in English. It shows, then, how they offer to recover extant lines of literature that have been hidden, ready for any scholar to use with their own critical methods. As the Victorian period's longest serving Poet Laureate, Tennyson forms an important part of this narrative: a bridge between the Romantics and moderns, Regency and Victorian. Within this pivotal stretch of decades, we now possess new insights into the ink properties and paper with which Tennyson was writing at selected moments—work which offers a new and more certain basis for verification of manuscripts in the future. The material circumstances in which he wrote, and the motifs of his cancellations reveal recurrent patterns of thought, of immediate salience for Tennyson and modern literary studies. And if, as some critics have theorized, the text is inherently fluid and multiple,<sup>55</sup> then in that plurality lies also a means of restoring the author not as the controller of 'intentionality', but as 'maker', to translate Sidney's term in 'The Defence of Poesy'.<sup>56</sup> For the ghosts of Tennyson's texts that never made it to publication support the guiding aim of the OUP *Complete Works of Alfred Tennyson*: to move beyond the totality and monumentality of final authorial intention and towards an open encounter with the revision and contingency of poetic process. Opening up the sheer singularity of literary texts, and how their many variants evolve, offers a bridge between the formal and intellectual-historical study of verse and prose: one that accounts for the material circumstances and afterlife of composition and, in translating and restoring them in a digital sphere, enwraps them still more closely in the act of critical interpretation.

<sup>52</sup> For the term 'ghost word' in relation to multispectral imaging of ancient palimpsests, see the digital record of Cambridge University Library's public exhibition *Ghost Words: Reading the Past* (pubd online March 2021) <<https://www.cam.ac.uk/stories/ghostwords>> accessed 19 August 2024.

<sup>53</sup> See Dirk Van Hulle, *Genetic Criticism: Tracing Creativity in Literature* (Oxford, 2022), 165; see also Kathryn Sutherland, *Why Modern Manuscripts Matter* (Oxford, 2022), 208.

<sup>54</sup> On the notion of the imagination in particular as an idea that develops in writers' circles, see James Engell, *The Creative Imagination: Enlightenment to Romanticism* (Cambridge, MA, 1981).

<sup>55</sup> John Bryant, *The Fluid Text: A Theory of Revision and Editing for Book and Screen* (Ann Arbor, MI, 2002).

<sup>56</sup> See Sidney's statement that 'The Greeks called him a "poet", [...] It cometh of this word [*poiein*], which is, to make': 'The Defence of Poesy', in *Miscellaneous Prose of Sir Philip Sidney*, ed. Katherine Duncan-Jones and Jan van Dorsten (Oxford, 1973), 77.



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