The Immortal Shakspeare: Transcribing a micro-calligraphic drawing

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A poster-sized drawing from the 19th Century portrays Shakespeare’s monument in Holy Trinity Church, Stratford-upon-Avon. The linework is composed of tiny lettering, less than 1 mm in height, running in a continuous path throughout the design. Direct transcription of the text proved to be difficult. The print was digitised at 1200 dpi and image processing techniques were tried to follow the text lines and recognise the characters, but they were ineffective because of the irregularity of the writing. A software viewer was developed to facilitate navigation of the text on screen, with functions for enlargement, translation and rotation, and for constructing and editing a trajectory line following the path of the text. The text was fully transcribed and three sources were identified from the 1840s.

Shakespeare. Micro-calligraphy. Lithograph. Transcription. Image processing. Viewing software.

1. INTRODUCTION

A curious and very rare print entitled ‘The Immortal Shakspeare’ was found in the mid-1930s among diverse objects and paintings in a cellar below a former souvenir shop in Stratford-upon-Avon. A scrap merchant was clearing the shop of its fittings, when his truck suddenly fell through the floor into a forgotten cellar, in which were stored all manner of curiosities related to Shakespeare. This had been known as the Shakespearean Depôt, owned by William Pearce, at 6-7 Bridge Street, a prime tourist location in the midst of several large hotels in the town centre. The building later became the Woolworths store (now Poundland).

The print appears to be a lithograph in maroon/sepia ink and has areas of discoloration owing to water damage, with various tears at the edges. At some time in the past, perhaps after it was rescued from the damp cellar, the original has been roughly cut to a size of approximately 380 x 440 mm and glued onto a heavy cream paper of 495 x 553 mm.

At first glance, this is a line drawing of Shakespeare, done in ink with thick lines (Fig. 1). The central design is clearly based on the monument in the chancel in Holy Trinity Church, Stratford-upon-Avon, mounted on the wall above his grave. Closer inspection reveals that the lines are composed of text in tiny letters. But how to read it? Could the text be transcribed from the drawing? What does it say? Who created this remarkable work of art?

2. MICRO-CALLIGRAPHY

Micro-calligraphy, sometimes called micrography, is defined in the OED as the ‘art of writing in microscopic characters’. It is also an ancient Jewish art form: ‘a word or piece of text in which the design and layout of the letters creates a visual image related to the meaning of the words themselves’. It seems to have arisen from the tension, ever since the time of Moses, between prohibition and usage of images in Judaic religious practice. The second commandment, ‘Thou shalt not make unto thee any graven image, or any likeness of any thing …’ forbade representations of God as a focus for worship. It was particularly aimed at making idols in the pagan fashion, which infuriated Jahweh in repeated episodes throughout the Old Testament.

Yet artistic expression flourished in Jewish culture. From the ninth century AD onwards Jewish scribes began to form their writing in a decorative way, with the justification that its primary function was text that carried the meaning of the words, and the form it took was merely a way of rendering. It appeared in the miniscule marginal notes in the Hebrew Bible and in little doorpost scrolls. The wording came to be combined with ornamental motifs and geometric designs in borders and title pages. Space-filling techniques with closely-knit lines of text covering large areas enabled textural effects and modulation of the density. Slowly the practice spread from Israel to Egypt and into Europe (Avrin 2013).
By the early 1600s, Italian scribes were decorating marriage contracts with micro-calligraphy, using verses from the Song of Solomon, Psalms and Proverbs, drawing them in geometric and architectural forms, flowers and family crests. In Europe, from the 18th century, micrographic pictures were being drawn on parchment or paper to be hung as decorative art in homes. Micrographic portraits of royalty also began to appear. By the 19th century popular subjects included Jewish leaders such as Moses and Abraham, biblical scenes, and holy sites in Jerusalem. Micrographers emigrated and established themselves in England, France, Holland, Russia and Poland, and toward the end of the century the art was introduced to America.
3. THE ARTIST

A line of text at the bottom edge of the Shakspeare print, revealed when the mount card was removed, gives the identity of the artist:

![Figure 2: Detail 50 x 3.6 mm at lower edge of print](image)

Louis Glück (1804–1874) was born in Prussia. He became fluent in a number of languages, including Hebrew, and styled himself as a 'professor of languages'. He worked for a closer understanding between Jews and Christians and maintained a regular correspondence with many leading figures from both communities. He emigrated in 1836 to Great Britain, took lodgings in the East End of London, and started to make a name for himself as an artist, working in oils, watercolours, and his speciality of micro-calligraphy (Laidlaw 2004). This demanding task brought on considerable eyestrain, for which he was admitted to the London Hospital in 1840. His other known surviving works are micrographic portraits of Queen Victoria (in the Royal Collection, Windsor, and the Victoria & Albert Museum), the Duke of Sussex (British Museum) and John Wesley (in the Wesley Museum at Epworth Old Rectory and the New Room Museum in Bristol).

![Figure 3: Micro-calligraphic portrait of John Wesley](image)

Glück composed the texts of his royal micrographic portraits after a series of interviews with the prince consort and the duke. He also published them in book form: Biographical Memoir of Her Most Gracious Majesty Queen Victoria (1844) and A Biographical Memoir of his Late Royal Highness, the Duke of Sussex (1846). For the latter, he used the pen-name 'L. Glück Rosenthal', as it appears on his drawings. For John Wesley (1851) in Fig. 3, he used a well-known portrait painting as the model, and took the text from several biographies (Ryan 2014). Wesley’s robe is rendered in closely-spaced lines of text, in the traditional Jewish manner, but the surrounding frame is more decorative in style. The total word count is 13,875 words.

Glück’s technique was first to make a faint line drawing of the portrait. He would then write the many thousands of words along the line, adapting the design and weaving the letters together to create a portrait that brought out the character of the subject. Lithography had been invented by Senefelder in 1796 and was at first used to print music. By the 1820s the lithographic technique was widely employed by artists, drawing or writing onto a polished limestone surface in reverse with a wax crayon or a pen using a special greasy ink. This was a difficult task because the artist not only had to work in mirror image, but also had to keep his hands off the surface of the stone to avoid smudging. Glück adopted instead the ‘transfer lithograph’ method using a specially coated paper to make the drawing, which was then transferred onto a zinc plate. The advantages were that the artist did not have to work in reverse, and when the work had finally been completed it could be transferred to the printing plate by a well-tested method (Gascoigne 2004).

It is likely that many copies of the Shakespeare design were printed, but the only other known copy today is in the collection of the Folger Library in Washington (Folger, 2021). The notes say: ‘A likeness of the Stratford bust done in micrography, a style of art where the image is delineated by lines of text, in this case lines from Shakespeare’s plays or data concerning his life.’ The Folger print gives the artist’s address as 3 Prospect Place, New Charlton, Woolwich, whereas the Stratford print has 1 King’s Place, Commercial Rd, London (Fig. 2). According to the ODNB, Glück lived at the Woolwich address from 1846 to 1856, then at King’s Place until the early 1860s. This suggests that there were two editions of the Shakespeare print.

4. DIGITISATION

The dismounted print was scanned at 1200 dpi on an Epson GT-10000+ flatbed A3 scanner. Because of the large size of the original, the upper and lower halves were scanned separately and then merged in Photoshop, yielding a digital image of 19230x22000 pixels. 1200 dots per inch is equivalent to sampling the surface at 47 points per mm, so the pixel spacing is 21 μm. This is sufficient to resolve the finest detail that can be rendered by
human hand (MacDonald 2010). The very high spatial resolution gives clear definition of the micrographic text, as shown in Fig. 4, a detail from Shakespeare's right eye, of size 400x400 pixels. The diameter of the letter 'O' ranges from 30 to 40 pixels, i.e. 0.64 to 0.85 mm. The overall height of the characters, from the bottom of the descenders to the top of the ascenders, ranges from 90 to 120 pixels, i.e. 1.9 to 2.5 mm. This corresponds to type sizes of approximately 5 to 7 points.

The source of the text was not clear at the outset of the study: whether it was something original, written by Louis Glück himself, or whether it was copied from another work. The objectives of the investigation were therefore to transcribe the text by following the sinuous lines and then, if possible, to identify the source(s). It quickly became apparent, however, that the transcribing could not easily be done by direct reading from the original print. Of course the original is too fragile for repeated handling, so a printed facsimile would have to be used. In addition the print area is larger than A2 and therefore takes some effort to manipulate physically in order to get close enough to see every word. Moreover, the lettering is very small and near the threshold of visual acuity, necessitating bright illumination and/or the use of a magnifying glass.

Most frustratingly, the line of text winds endlessly around, sometimes in spirals, sometimes doubling back on itself in serpentine fashion, sometimes crossing over its path, so that one continually has to turn the printed sheet to orientate the text for normal reading. Because of the complexity of the design, it is easy to 'lose the place' when attention is diverted, for example when looking away to write or type on a keyboard (although this might be alleviated by use of a voice recorder). To make matters worse, the lettering is not uniform but changes in size and slope from letter to letter, and in some places is distorted or faded. It took six months to transcribe Glück's drawing of John Wesley, working from a photostat copy (Onstott 1935). None of this is surprising, considering the extreme difficulty that Glück himself must have experienced when writing the original. It is extraordinary that he was able to do it at all!

5. APPLICATION OF IMAGE PROCESSING

Suppose that image processing techniques could be employed to follow the curvature of the lines of text? In an ideal scenario, one could automatically locate the trajectory and then unfold or unwind it into a linear text line that would be easier to transcribe. Better still, perhaps character recognition could then be applied to the linear text, by training an algorithm on the written letter forms?

The approach tried was to search along the digital text trajectory, looking ahead to determine the most likely direction of travel. Different vector lengths and angular weighting factors were tried, but invariably there were places where the wrong track was followed, even for simple cases (Fig. 5). In other cases such as Fig. 6 (left) the text path is very convoluted, and it is not at all obvious where the correct trajectory should go.
Another example is shown in Fig. 6 (right), where the text reads ‘several grants of arms to’ but after each word the connectivity is unclear. Only an iterative semantic method would be successful, in which meaning would guide the identification of letters and words and the connections between them.

In some places there are insertions of decorative features, which look like text but are not part of the narrative. For example, in Fig. 7 (left) are shown two of the buttons, saying ‘1564 born’ and ‘1616 died’. These alternate all the way down Shakespeare’s waistcoat, but have no association with the vertical lines of text on each side. Likewise the names of all 36 plays appear in large letters in the garlands down either side (Fig. 7 right) but have no connection with the surrounding text lines. The name ‘William Shakspeare’ is also used as the central midrib of each leaf in the garlands, sometimes with numerical dates for the side veins.

Irregularity in the letter forms would make the task of automated optical character recognition (OCR) more difficult. For example, in Fig. 8 (left) the word ‘held’ has the ‘d’ written in reverse. In Fig. 8 (right) the word ‘friends’ has the ‘s’ reversed and the ‘e’ is an odd shape and the ‘n’ is missing.

The problems are similar in some ways to those of transcribing manuscripts written in Elizabethan ‘secretary hand’. Ambiguities in letter forms can only be resolved through recognition of whole words and phrases, and it takes time to become familiar with the style and conventions of the writer. It would have been easy to waste a great deal of effort trying to develop a sophisticated algorithm to adapt to every aspect of the changeable line of text, overcoming areas of uncertainty and avoiding false paths.

6. INTERACTIVE IMAGE VIEWER

The purpose of this study was not to produce a generalised tool for transcribing all micrographic drawings, just to facilitate the transcription of this particular drawing. An alternative to reading from the physical print is to view the digital image using standard software such as Adobe Photoshop. But it is still not at all easy, because of the need to rotate the view very frequently, and the very large image size slows down the processing speed – the full image in 24-bit RGB format occupies 649 Mbyte. Segmenting it into more convenient smaller pieces leads to problems at the edges when the text crosses from one piece to another.

The Folger Library provides an online viewer for images in their LUNA library, with facilities for zooming and rotation by increments of 90°. The magnified image may be dragged around by holding down the mouse button, and moved left-right and up-down by use of the arrow keys. There is a navigation window to show where the magnified section lies in the overall image. Annotation tools are available to draw lines or shapes, together with explanatory text, in a separate layer. An attempt to use this viewer to read the text, however, revealed that it was not ideal, with some of the same problems as for reading a physical print: rotational increments not fine enough, easy to lose the current position, and difficult to relate the text stream to the image coordinates. The opinion of the Folger librarian, Abbie Weinberg, was that the task of transcribing the whole work would be "moderately Herculean".

Hence a software viewer was developed in Matlab for displaying a section of the drawing. The complete high-resolution image is held in a memory buffer, and a selected area rendered in a window approximately half the width of the HD display screen. This leaves space on the screen for a second window running a text editor (Microsoft Word) for typing the transcription.

Two organising principles were adopted to impose some structure on the text and its spatial layout. First, the text was chunked into numbered paragraphs of length 80-100 words. Second, the trajectory for each paragraph was recorded as an ordered list of up to 120 coordinate pairs.

The viewer has four different modes of operation:

1. Viewing of the print, using keyboard characters for convenient zooming, rotation and movement. The complete image is held in a memory buffer and the rectangular display window mapped onto it by the standard trigonometric transformation:

\[
\begin{bmatrix}
{x_d} \\
y_d
\end{bmatrix} = \begin{bmatrix}
x_c \\
y_c
\end{bmatrix} + m \begin{bmatrix}
\cos\theta & \sin\theta \\
-\sin\theta & \cos\theta
\end{bmatrix} \begin{bmatrix}
x_i \\
y_i
\end{bmatrix}
\]
where:

\[ [x_{td}, y_{td}] \] are the target coordinates in the full image (rounded to the nearest pixel);
\[ [x_c, y_c] \] are the image pixel coordinates of the current centre of view;
\[ [x_i, y_i] \] are address coordinates spanning area of display window \([-w/2 +0.5 : +w/2 −0.5]\);

\( m \) is the magnification factor (<1 to reduce, >1 to enlarge);
\( \theta \) is the rotation angle (degrees).

Image manipulation commands enable change of \( \theta \) to rotate the image by increments of ±15°, ±90° and 180°; change of \( m \) by factors of \( \sqrt{2} \); and step change of \([x_c, y_c]\) for translation up/down or left/right. The computation of Eq. 1 is applied to every pixel in the display window each time the display is refreshed.

Figure 9: Section of viewer screen showing marker (red) and focal (green) points

(2) Construction of the trajectory. A numbered red marker point is placed at the start of trajectory for each paragraph by a click of the left mouse button. Successive segment points along the trajectory are entered by the right mouse button. Commands enable moving back and forth between paragraphs to bring any numbered point to the centre of view. A focal point, denoted by a green cross, may be placed anywhere as an aid to navigation (Fig. 9).

(3) Editing mode enables individual segment points within the trajectory of one paragraph to be added, moved or deleted. The segment lines may optionally be displayed as a transparent blue overlay (Fig. 10).

(4) Visualisation of the full print area, scaled to fill the display window height, showing in blue overlay the trajectory of one or more paragraphs. A coarse 7x9 grid is also defined over the print area, shown by overlay of green lines, with horizontal coordinate (column) A–G and vertical coordinate (row) 1–9.

Figure 10: Section of viewer screen showing trajectory segments overlaid on the text in blue

7. SOURCE OF THE TEXT

The purpose-made software viewer facilitated the complete transcription of the text. Altogether 104 paragraphs were produced, with a total of approximately 7,700 segments (an average of 73 segments per paragraph). The total number of words, excluding the names of the 36 plays, is just under 8,900 (an average of 85 words per paragraph). The starting point of the text is at the bottom left, indicated by a pointing finger, and the trajectory goes up the pillar and muse on the left side, down and back up the left garland, across the top, down the muse and pillar on the right, around the lower part of the right garland, all around the central figure of Shakespeare and finally up the remaining portion of the right garland, finishing just above Richard II (beside the muse’s lyre).

Once the text had been transcribed, it was possible to search through online archival reference files, particularly in archive.org and Google books, to find a match on phrases with distinctive wording. Three sources were identified, primarily the section ‘Life and Writings of Shakspere’ in the Introductory Volume of The Pictorial Shakspere by Charles Knight, published in 1846. This was a condensed version of Knight’s book William Shakspere: A Biography, first published in 1839 and repeated in numerous editions throughout the 19th century, and also used as a source of text. A third source was the section ‘Sketch of the Life of Shakspeare’ in Volume 1 of The Plays of William Shakspeare, ed. George Steevens and Alexander Chalmers (1805).

Knight’s series of publications contributed enormously to the growing market in the 1800s for Shakespeare’s works, which was inextricably linked
to the ever-expanding Victorian cult of ‘bardolatry’ (Young 2009). Knight’s biography was the ‘standard life’ of Shakespeare, and was a point of reference for many authors during the period that Glück was active. Of the 104 paragraphs in the transcription, 88 were from Knight’s *Pictorial Shakspeare*, 15 were from Steevens, and 1 was from Knight’s biography. All of these were copied verbatim from the sources, without paraphrasing, albeit with numerous spelling errors, missing words, and absence of most of the punctuation.

The artist added nothing of his own except the final sentence: ‘Thole of this design was executed and written during a period of six days by Louis Glück Rosenthal on the first of June 1849, in the forty seventh year of his age’. This seems to have been a missed opportunity: as a humanitarian and man of letters, he could have expressed his own opinions on the values and creative ideas of Shakespeare, leaving a kind of time capsule for posterity, embedded within the calligraphy.

Knight’s book contains an engraving of the Shakespeare monument in Holy Trinity, shown in Fig. 11. Comparison with Fig. 1 indicates that Glück followed the design closely, apart from compression of the crest and skull at the top, and added on each side luxuriant garlands with a playful muse on a pedestal. It was a common convention in the 18th century to depict the Greek muses of Comedy (Thalia) and Tragedy (Melpomene) on either side of a person associated with dramatic art, usually with comedy on the left and tragedy on the right. For example, in a celebrated painting of 1761, Joshua Reynolds showed the actor David Garrick caught between the muses, hesitating as if uncertain which way to turn. A delightful engraving of 1778 by Chodowiecki shows the two muses attending to Shakespeare’s coiffure and laurel wreath (Fig. 12).

Glück may have also been influenced by the muses on the magnificent marble sculpture by Thomas Banks, officially known as ‘Shakespeare seated between the Dramatic Muse and the Genius of Painting’, which at that time stood over the entrance to the British Institution in Pall Mall, formerly John Boydell’s Shakespeare Art Gallery from 1789 to 1805. The sculpture was removed to Stratford-upon-Avon in 1871, and is now installed at the far end of the Great Garden behind New Place.

8. REFERENCES

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The transcription and supporting files have been archived at: DOI: 10.13140/RG.2.2.33748.68485

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**Figure 11: Engraving of the Shakespeare monument, in Knight’s biography (1843 edition, p.532)**
The family ancestry (Knight):

[1] William Shakspere was born at Stratford upon Avon in Warwickshire on the 23rd day of April 1564. Of the rank of his family it is not easy to form an opinion. A public document bearing the date of 1596 affirms of John Shakspere of Stratford upon Avon the father of William Shakspere that his parent and late antecessors were for their valiant and faithful services, advanced and rewarded of the most prudent prince king Henry VII of famous memory, and it adds silence which time they have continued at these parts of Warwickshire in good reputation and credit.

Commercial nous (Knight, quoting Rowe): [57-59] … in the time of Elizabeth, coaches being yet uncommon and hired coaches not at all in use, those who were too proud, too tender, or too idle to walk went on horseback to any distant business or diversion. Many came on horseback to the play and when Shakspere fled to London from the terror of a criminal prosecution, his first expedient was to wait at the door of the playhouse and hold the horses of those that had no servants that they might be ready again after the performance. In this office he became so conspicuous for his care and readiness that in a short time every man as he alighted called for Will Shakspere and scarcely any other waiter was trusted with a horse while Will Shakspere could be had. This was the first dawn of better fortune. Shakspere finding more horses put into his hand than he could hold, hired boys to wait under his inspection who, when Will Shakspere was summoned, were immediately to present themselves as “I am Shakspere’s boy, Sir”. In time Shakspere found hire employment but as long as the practice of riding to the playhouse continued the waiters that held the horses retained the appellation of Shakspere’s boys.

Dalliance with the Davenants (Steevens): [77-78] If tradition may be trusted, Shakspere often baited at the Crown Inn or tavern in Oxford in his journey to and from London. The landlady was a woman of great beauty and sprightly wit, and her husband Mr John Davenant, afterwards mayor of that city, a grave melancholy man, who as well as his wife used much to delight in Shakspere’s pleasant company. Their son, young Will Davenant, was then a little schoolboy in the town of about seven or eight years old, and so fond also of Shakspere that whenever he heard of his arrival he would fly from school to see him. One day an old townsman observing the boy running homeward, almost out of breath, asked him whither he was posting in that heat and hurry. He answered to see his Godfather Shakspere. There’s a good boy, said the other, but have a care that you don’t take God’s name in vain.

The incomparable genius (Knight): [88-90] These productions afford the most abundant evidence that the greatest of intellects was in the most fearful possession of its powers. The influence of time in the formation and direction of the poetical power must yet be taken into account as well as a temper arising out of passing events. Shakspere was now thirty seven years of age. He had attained to the consciousness of his own intellectual strength, and he had acquired by long practice the mastery of his own genius. He had learnt to direct the stage to a higher and more noble purpose than those of mere amusement. It might be carried farther into the teaching of the highest philosophy through the medium of the grandest poetry. The Epoch which produced Othello, Lear, Macbeth has been described as exhibiting the genius of Shakspere in full possession and habitual exercise of power as its very point of culmination.