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A closer look at Raphael's drawings at the Ashmolean: how this has informed our view of their conservation requirements

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A closer look at Raphael's drawings at the Ashmolean: how this has informed our view of their conservation requirements

Abstract
In 1846 the Ashmolean Museum acquired an extensive collection of Raphael drawings. These include a range of preparatory sketches and working drawings, and characterise his working technique. From the outset, Raphael's drawings were highly prized, and over time their identity has shifted completely from working drawings to highly valued art works. While undertaking a project to rehouse forty drawings by Raphael, the Paper Conservators at the Ashmolean took the opportunity to examine the drawings thoroughly using non-invasive techniques with a view to building a resource to support future academic research and understanding. Most revealing was the use of Reflectance Transformation Imaging (RTI), enabling a clear view of the characteristics of the drawing's surface giving an insight into the extent of Raphael's use of blind stylus for under-drawing. This paper outlines the observations made using these techniques, how this informed our understanding of the drawings and influenced their subsequent re-housing.

Keywords
Raphael drawings; RTI; blind stylus; underdrawing; housing; double-sided mounts

Introduction

The Ashmolean houses a significant number of drawings by Raphael, one of the largest collections of his drawings in existence. Originally made as part of his creative process, these drawings have undergone a huge shift in identity since their creation: from working drawings to Old Master Drawings, from sheets of paper lying loose around his studio to highly prized and carefully housed artworks, from functional to intellectual, from being part of a process to being significant in their own right. This transition started even in his own time, in his own studio, where drawings were often kept as working examples for his apprentices to use, thus evolving from working drawing to teaching model almost from the outset. The fact that his drawings were valued and collected from the beginning is doubtlessly why they survived.

This paper takes a look at some of the Raphael drawings in the Ashmolean collection that were part of a recent project, undertaken by the paper conservators at the museum and funded by the Stockman Foundation. The project provided an ideal opportunity to take a closer look at the drawings, recording a detailed profile of each from a material and conservation perspective with a view to enhancing the available records. Indeed, this aspect of the project

Fig. 1 (left) WA1846.168, Raphael, 'Recto: Study for St Catherine'; (centre) WA1846.209, Raphael, 'Studies of the heads of two apostles and of their hands'; (right) WA1846.195, Raphael, 'Recto: Allegorical Figure of Theology.' Images © Ashmolean Museum, University of Oxford.

became more significant as time progressed, eventually feeding into the recent exhibition *Raphael, The Drawings* at the Ashmolean in 2017. An outline of the project, the types of examination used and the observations made will be discussed below, showing how this informed our view of the drawings and future treatment of them.

The Drawings

The Ashmolean came to house the collection of drawings by Raphael in 1845 largely through the acquisition of around 150 drawings attributed to him from the private collection of Sir Thomas Lawrence.[1] Of these drawings, 75 are now held through contemporary scholarship to be by the artist, while the rest are identified as 'attributed to,' 'school of,' and so on. Subsequent gifts and acquisitions have enriched the collection further and today the Ashmolean collection boasts around 80 drawings by Raphael. But, as with many Old Master drawings, there is some shifting of attribution with developments in scholarship; for example, one of the drawings in the collection currently attributed to Perugino has recently been identified as actually being by Raphael.

Within the collection there are drawings which represent all the different stages in Raphael's working process: preparatory sketches, careful studies from models, deliberate figure studies and groupings, and fine finished drawings. There are many double-sided sheets, and often the figures are juxtaposed in a seemingly random way in different orientations and in different media. Broadly speaking, they can be categorised as: an embodiment of Raphael's thinking through and developing of an idea, as functional working drawings (studies from models or drawings for transfer), as examples for his apprentices to learn from, or as drawings created as works of art in their own right.

The materials and techniques he used encompass the full range of media available at the time, and present a masterclass in contemporary working practise: drawings are in iron gall ink; in black, red and white chalk; in charcoal; in metal point; and there is evidence of his use of lead white heightening. He used blind stylus as a means of placing groups of figures on a page, to sketch out initial thoughts and in some instances to create a geometric construction of a composition. There are also examples in the collection of his use of transfer techniques using pouncing, squaring and stylus incisions.

As a body of work they give us an invaluable understanding of his working practice and his development as an artist, every individual characteristic and component of each drawing revealing further insight into his method and technique.

The Raphael drawings are highly regarded within the museum collection and their significance is reflected in the high level of interest in them by academics, scholars, study groups and private visitors to the Western art print room. They are repeatedly requested on loan, frequently part of in-house exhibitions and regularly used for teaching within the academic syllabus of the University. This raises particular issues with exposure, handling and accessibility. Historically the Old Master drawings were on permanent display, but today a more controlled approach has been established: careful exposure records are kept to inform a controlled rotation of drawings for viewing by appointment in the print room (unless a specific request is made) and the most vulnerable drawings only made available for the most serious scholarly study.

The Project

The project was initially conceived to rehouse 40 of the Raphael drawings, with a view to establishing a precedent for rehousing all of the Old Master drawings in the Ashmolean collection. At a very early stage it became evident that this would present an opportunity to compile a thorough record of the drawings while they were out of their housing. Surprisingly, while they have been much studied, discussed and written about, there has been little consistency in the detail of the records kept at the museum. So, in collaboration with the curators, a plan was drawn up to compile as thorough a record as possible for each drawing, looking at the characteristics of the paper and the media and a careful examination of the drawing's condition. What little information we have about any historic conservation treatment of the drawings was included in the record.

Conservation and Technical Examination

The drawings were examined and analysed thoroughly with the means that we already had at our disposal. Observations were made using the naked eye, in ambient, transmitted and

1 Thomas Lawrence (1769–1830) was a leading English portrait painter and the fourth president of the Royal Academy. His collection of 150 drawings attributed to Raphael, and over 80 attributed to Michelangelo, was acquired by the Ashmolean after Lawrence's death thanks to the efforts of one of his agents, Samuel Woodburn, and was purchased for the Ashmolean by 'A body of Subscribers.'

Fig. 2 Detail of pouncing in transmitted light. WA1846.171, Raphael, 'Recto: Study of four standing Men in a Pietà.' Image © Ashmolean Museum, University of Oxford.

raking light, with infrared and ultraviolet light, and using binocular and digital microscopy. Further analysis was carried out using a handheld X-Ray fluorescence (XRF) spectrometer.

1. Examination with the naked eye
Careful observation with the naked eye using ambient, transmitted and raking light allowed an initial record of each drawing to be drawn up and a detailed overview of condition to be compiled, flagging up details demanding closer scrutiny. Basic technical information and observations such as the dimensions of the support, watermarks, collector's marks or stamps and the characteristics of the paper such as the fibre distribution, rope marks, inherent creasing and drying spots was documented consistently and thoroughly. The chain and laid lines were recorded, taking care to map measurements across the support to allow for inconsistencies due to the irregularities within the mould on which the paper had been made. Any other characteristics were noted and documented with careful diagrams drawn up to detail such features as pouncing and pinholes. Hopefully this bank of information will inform future academic examination and comparison of the drawings, and so reduce the need for every individual to carry out their own measurements and basic analysis.

Case study: WA1846.171, Study of Four Standing Men in a Pietà (Fig. 2)
Pouncing can be clearly seen in this example, but transmitted light revealed its full extent around the figures on the recto and verso, enabling documentation. While the pounced outlines would have been intended as a means of transfer, there is no evidence of black chalk or charcoal to confirm that it was used as such.

Initially a look at any evidence of incised lines was part of this examination using the naked eye, but technology superseded our use of a handheld torch as a source of raking light to best see them with. A summary of our look at incised lines is therefore discussed later in the section about RTI.

2. Examination under magnification
Magnification using a stereomicroscope allowed accurate and in-depth observation of both support and media.[2] This enabled better identification of media application and technique and revealed more detailed information about the condition of both the media and the support.

2 Stereomicroscope: Wild M5A by Wild Heerbrugg Ltd, Switzerland.

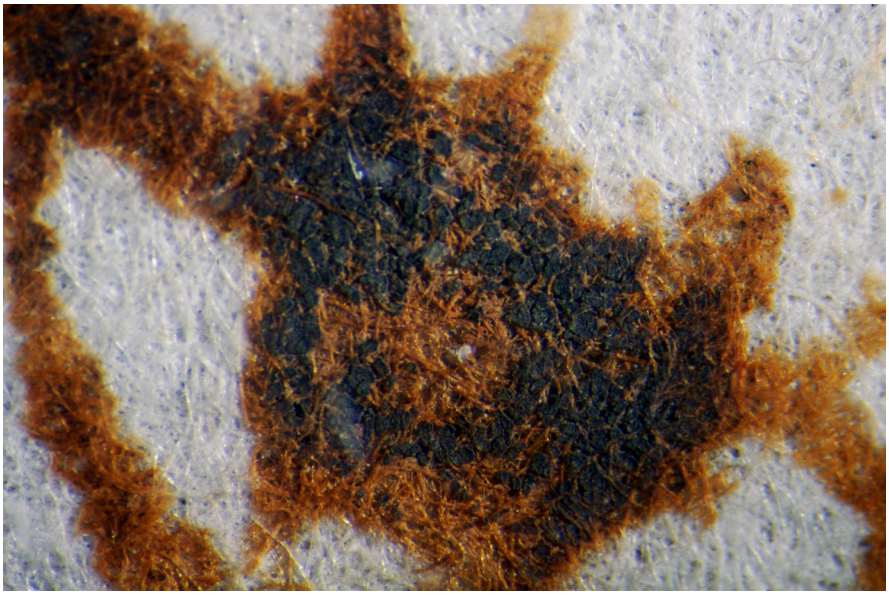

Fig. 3 Detail of iron gall ink under x25 magnification. WA1846.159, Raphael, 'Recto: Two Studies for a Virgin and Child with St John.' Image © Ashmolean Museum, University of Oxford.

i. Identification of media

- **Iron gall ink**[3]: iron gall ink has specific physical characteristics that can be seen with the naked eye, but which under magnification are even more apparent, making it recognisable and distinct from other brown inks. In areas of lighter application it appears merely as an orange-brown stain on the paper fibres and clues to its identity are not so clear. However, where the ink has been applied more heavily, a solid mass or residue sits on top of and within the fibres of the support. This residue generally appears as clumps of dark brown material, generally fractured and glossy. In some areas the fibres of the support around this residue appear dusty and in places clumps appear to have dropped off the surface of the support, leaving indentations in the surface where the fibres have crumbled under the ink, and a brown stain on the remaining fibres. Where corrosion is more severe, the ink has caused a breakdown of the cellulose fibres resulting in fractures along the drawn lines. Fibres along these splits appear short and brittle where they have snapped apart and in some instances there are areas of loss where fractures intersect. Thankfully, while most of the iron gall ink drawings examined exhibited some corrosion, only a small number were suffering from such severe deterioration.
- **Chalk/charcoal**: In historic catalogue entries, a number of Raphael's drawings are described as being in black chalk. However, in a number of these drawings the black media used appears as different hues of black and our curators were keen to look at this in more detail.

  Theoretically it is possible to distinguish between black chalk and charcoal from the appearance of the particles under magnification: charcoal particles have a sharp, splintered appearance derived from the fine structure of the wood from which it is made. The individual particles are virtually weightless and scatter unevenly as they splinter from the stick, sinking into the fibrous mesh of the paper surface along and around the drawn line. The result is an irregular line with limited covering power and consequently less intensity of colour. The colour of charcoal tends to be a brown- or grey-black.

  Natural black chalk, as was used in this period, is a soft carbonaceous schist with carbon and clay as its principal ingredients. Good quality chalk, because of the compressed and cohesive structure of the granular material, tended to produce a more linear, consistent stroke (although softer effects could be achieved by smudging with stump or finger). Because of the clay content the chalk sits over the fibres, a long stroke will catch at ridges and impurities.

  In practice, however, it is extremely difficult to definitively identify one from the other. Because of the age of the drawings some of the media has inevitably been lost

3 Various methods of identifying iron gall ink were researched and some of the drawings were analysed using XRF which was able to confirm the presence of iron, but since Raphael's use of iron gall ink is well documented, and because with careful observation under magnification the distinctive characteristics of the ink are easily recognisable no further analysis was considered necessary for this project.

and abrasion has worn down much of its original character. The thin layer that remains does so because it has sunk into the fibrous mesh of the support, and larger particles have come adrift with time and historic treatment. However, there is one characteristic of charcoal particles that sets them apart from chalk: charcoal particles sometimes reflect light from their splintered faceted surfaces to give a golden sparkle. Care must be taken not to confuse this with reflected light from sizing, fixative or adhesive residues that might be present, but if the sparkle can be located and comes from a particle of black media it is likely to be charcoal. Examination of the presumed black chalk drawings in the project revealed that many of them are, in fact, at least partially drawn in charcoal.

ii. Identification of condition

With no historic record of the condition of the drawings beyond a few spare comments by Parker in his catalogue,[4] close examination was the only way to judge the current condition of the drawings and to surmise what treatment might have occurred in the past. A magnified view of the support generally confirmed what was already suspected, but in some instances revealed information entirely invisible to the naked eye.

4 K.T. Parker, *Catalogue of the Collection of Drawings in the Ashmolean Museum*, Volume II (Oxford: Oxford University Press, 1972).

Case study: WA1846.170, The Lamentation (study for the entombment of Christ) (Fig. 4)

Without magnification it is clear that the iron gall ink in this drawing has corroded the paper in many areas, causing multiple losses. At first glance it appears extremely fragile but sensitively repaired; however, closer examination under magnification revealed a rather different story. It is clear that the ink was used freely and thickly in some areas and that this has resulted in severe degradation of the support. For a drawing in this condition microscopic examination should reveal the ink to exist as a solid residual matter on the surface of the support where the lines are at their darkest and thickest, with some inevitable loss where the crumbling fibres have dropped the solid clumps. However, in this drawing no solid matter was found at all, in any part of the support. All that remains of the ink is the stain left on the matted and dusty-looking surface fibres. Furthermore, the surface of the paper is unusually flat, with little trace left of the usual textural imprint from felts. Evidently the drawing has undergone some sort of vigorous treatment in the past which has removed the 'body' of the

Fig. 4 WA1846.170, Raphael, 'The Lamentation (study for the Entombment of Christ).' Image © Ashmolean Museum, University of Oxford.

iron gall ink from the surface of the entire drawing and any inherent textural qualities the paper may have once had have been flattened out, possibly by the lining process.

iii. Further observations under magnification

- **Grounds**: Examination under magnification enabled a clearer view of their characteristics and condition of the ground: impurities, air bubbles and particulate matter not visible to the naked eye could be seen and the extent of cracking revealed just how brittle and fragile the grounds are.

Case study: WA1846.154, Recto: 'Group of standing soldiers'
Magnification revealed that the blue media used in the ground could be identified as ultramarine[5] and that previous conservation had caused some damage to the ground: while cracks are evident over the entire surface of the ground, particularly along some of the lines from the metal point stylus, there is consistent cracking along the line of the ridge caused by the historic inlay. Evidently the bevelled edge of the inlay attached along the edges of the verso of the support resulted in some distortion, causing the ground to crack.

- **White crystalline deposits**: On many of the supports small translucent white deposits with a crystalline appearance were observed under magnification. They were consistently found scattered across the surface of the drawings in iron gall ink, and while further research is necessary to try to identify the material, it can be deduced that it must have been applied to the ink as some sort of treatment process.

5 *CAMEO: Conservation & Art Materials Encyclopedia Online*, http://cameo.mfa.org/wiki/Main_Page.

6 UV Light: UV-H 255 BL Ultraviolet 250w Flood Lamp by UV Light Technology Ltd, Birmingham.

7 IR reflectographs captured with Nikon D90 camera converted for infrared photography with a Sigma 50mm 1:2.8 DG macro lens and IR850 digital high-definition filter.

Fig. 5 Detail taken under ultraviolet light. WA1846.158, Raphael, 'Portrait of an unknown youth.' Image © Ashmolean Museum, University of Oxford.

3. Examination with ultraviolet light (UV)[6]
Every drawing in the project was carefully examined under UV light, and UV-reflected digital images were taken. Since many of the double-sided drawings were mounted with acrylic glazing (either as a sandwich or just in the verso window), UV examination could only be carried out once the drawings had been removed from their old mounts. Any observations were noted in the individual condition reports. On the whole, the observations confirmed what was already visible to the naked eye : the extent of any organic adhesive residues, differences in repair papers, and the presence of other organic material causing staining. The images also exaggerate the contrast between the paper fibres of the support which fluoresce, and any carbon-based media on the paper which absorbs UV, appearing exaggeratedly black. This has the effect of enhancing the carbon lines of the drawings, where black chalk deposits exist from transfer through pouncing, and where chalk or dirt has become ingrained in areas of historic damage to the paper of the support.

Case study: WA1846.158, 'Portrait of an unknown youth' (Fig. 5)
White heightening was noted in a historic catalogue entry for this drawing, but to the nake eye is no longer visible. It appears however, that a mechanical treatment has taken place which has resulted in the removal of most of the lead white and enough of the surrounding media to leave a very light 'halo' effect. Examination under UV light clearly revealed that traces of the media remain in the chin, nose and eyebrow, and furthermore, identification of the media was possible because under UV the traces appeared as dark shadows—absorbing the UV light—as is characteristic of lead white.

4. Examination with Infrared (IR)
Infrared reflectographs were taken of every drawing and examined in an attempt to identify any marks not readily visible in normal ambient light.[7] Because light in the IR spectrum is absorbed by carbon-based material, any marks made in black chalk or charcoal are intensified, while IR is largely reflected by iron gall ink,

consequently appearing invisible. This, in theory, should be an extremely useful way to look at iron gall ink drawings, allowing a clear view of any underdrawing beneath the ink. In practise, however, only some of the iron gall ink became invisible. More heavily drawn lines or parts of lines where the ink has become a solid, dense, particulate mass embedded in the fibrous web of the support remained clearly visible in the reflectographs.[8] As any faint traces of underdrawing were amplified with the IR absorption, however, they did become more visible, but nevertheless careful observation was required to distinguish the chalk lines from the ink lines which persisted.

In a similar way, IR can be a useful tool to examine metalpoint drawings. Lead, like carbon, absorbs the light in the infrared spectrum and thus appears intensified, while silver appears transparent. Interestingly, IR reflectographs of metalpoint drawings in the project, described in current catalogues as silverpoint only, display partial transparency of the lines of the drawing. It has been suggested that this is possibly because an amalgam was used.

Case study 1: WA1846.209, 'Studies of the heads of two Apostles and their hands'
Recent work revealed a faint drawing on the verso of the support when it was removed from the backboard of its old mount. Drawn in black chalk which is much abraded and reduced by time and wear, the faint sketch (by far less an artist; possibly a student of Raphael) is difficult to see with the naked eye. However, when seen in IR the chalk appears enhanced, making the sketch more visible and therefore easier to study.

Case study 2: WA.1846.160, Recto: 'The Virgin and Child with St John'
This iron gall ink drawing has been fully lined onto a secondary support, and while the sketch on the verso (which appears to be in black chalk) is visible in transmitted light, it is obscured by the drawing in ink on the recto. By taking an IR reflectograph of these drawings with transmitted light, it was possible to enhance the appearance of the chalk sketch on the verso while reducing the clarity of the iron gall ink drawing on the recto making it appear mostly invisible. This enabled a clearer view of the verso sketch.

5. X-ray fluorescence (XRF)[9]
We had hoped that readings taken with our handheld XRF spectrometer would reveal data to help identify media, grounds and potentially shed some light on historic treatments, but in reality, information gained from the readings was generally inconclusive. This was possibly because the size and density of the sample of media targeted was too small and sparse to produce a clear reading allowing interference from other elements present. The data collected therefore belonged not only to the material pinpointed, but also to the support beneath, any subsequent layers of fixative/residual chemicals from historic treatments etc. as well as whatever might be on the verso of the sheet. At best, readings could confirm what we already knew by giving an indication of a high level of an element associated with a material already identified. In this way we were able to confirm that the ink used is iron gall ink.

6. Reflectance transformation imaging (RTI)[10]
Our project was already well underway when a new piece of equipment came into the Conservation department, transforming the detail and accuracy of our view of the drawings under raking light. The reflectance transformation imaging (RTI) dome and hardware was loaned from the Oriental Institute, University of Oxford, to carry out a large cuneiform tablet survey, and a trial scan taken of one of our Raphael project drawings proved so interesting that we decided to scan all of the drawings, taking advantage of their unmounted condition to scan recto and verso.

In our current catalogue of the Ashmolean's Old Master Drawings, Parker describes faithfully where Raphael's blind stylus lines can be seen with the naked eye using raking light. In discussion with curators in the Western Art Department, we had already decided to look at this more closely, and had started documenting incised lines using raking light from a handheld torch.[11] A tantalising visit from Factum Arte, who scanned five of our Raphael drawings with their Lucida laser scanner—producing astonishing images of the topography of the drawings in which incised lines, pouncing, etc. are distinctly defined—intensified our interest, but unfortunately proved too expensive to take any further.[12] The success of the RTI, therefore, was a timely discovery.

The virtual 3D digital view of the drawings produced by the RTI software allows the user to zoom in, and to change the direction of the raking light and the filter to block or enhance

8 The extent that the ink became invisible in the reflectographs appears to relate directly to the density of the ink. Further research into this was not feasible within the constraints of the project.

9 Oxford Instruments X-MET 5100 handheld X-ray fluorescence spectrometer, dual condition set of 45kV, 15μA, 25um Fe filter and 15kV, 45uA 500um Al filter, and 30-second acquisition times.

10 Data captured using Nikon D3x with a Nikon ED AF Micro Nikkor 70-180nm 1.43-56.0 lens. Data processed using RTI Builder Version 2.0.2, RTI Viewer Version 1.1 from Cultural Heritage Imaging. RTI is a digital photographic technique aimed at enhancing the surface detail of objects. Between 40 to 70 digital images are taken of an object, shot with controlled, varying light positions. The light sources are positioned at a constant radius from the subject and surround it at incremental angles, forming a dome or hemisphere of light positions. The photographs are then fed into software, which builds a virtual three-dimensional digital image light source that is controlled interactively allowing the user to move the virtual light source around the image, zoom in and out, and change sharpness, contrast and other light and surface properties through a series of real time filters, thus often revealing surface details not visible to the naked eye under normal viewing conditions.

11 αspherilux midi LED by Analytik Jena AG, Germany.

12 The Lucida scanner is a laser scanner developed to obtain contact-free high-resolution 3D data from the surface of paintings and objects with low relief.

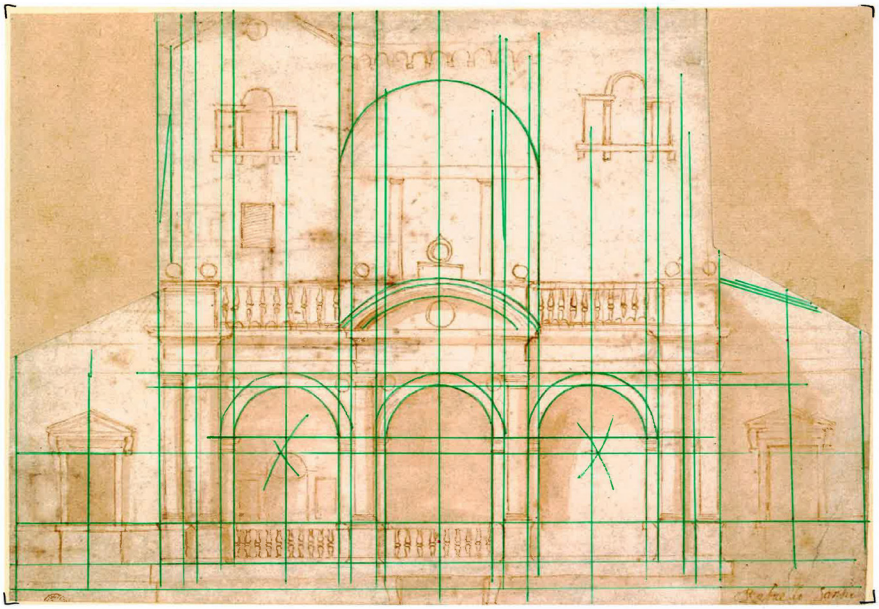

Fig. 6 Incised lines mapped from RTI scan. WA1846.215, Raphael, 'Recto: Architectural Design.' Image © Ashmolean Museum, University of Oxford.

information, which gives as clear a view as possible of the three dimensionality of the surface of the support. This enabled us to map blind stylus lines far more thoroughly than was previously possible, compiling detailed sketches of how they lie in relation to the drawing and revealing information in some instances that had not been previously visible.

Case study 1: WA1846.215, Recto: 'Architectural Design (Villa Madama)' (Fig. 6)

In this drawing, lines from a blind stylus criss-cross the entire composition. The lines are precisely placed and carefully drawn, and some of the architectural detail is positioned by holes pricked at strategic points along the lines. Raphael also used a blind stylus with a pair of compasses to draw the arches and in some instances to determine proportion, evident by the crossing arcs at the centre of the arches of the two flanking bays in the lower level.

While many of these lines were visible with normal raking light, RTI enables a much better view, the different filters and the ability to zoom into the images allowing us to see even the faintest lines and map the full extent of his use of blind stylus on the page.

Case study 2: WA1846.165, 'Group of Vintagers'

Vasari described the use of a stylus to trace a drawing onto a new sheet by going over the lines as being a practice often used by Raphael.[13] In this drawing the RTI allowed a clear and accurate view of blind stylus lines which were found to follow the sketched lines more precisely than in other drawings, and the two vertical lines evidently placing the two figures to the right of the sheet. This is perhaps because they were executed after the ink lines as a means of transfer to a second sheet.

Case study 3: WA1846.152a, 'Studies for the Virgin and Child with a book' (Fig. 7)

The RTI images of this drawing were the cause of some interest as they show clearly how Raphael used the blind stylus for freehand sketching. Several positions for the infant's head have been tried in blind stylus before the final ink lines were drawn, and also the Virgin's right hand around the infant Christ was initially placed on

13 Jonathan Stephenson, 'Stylus,' Grove Art, https://doi.org/10.1093/gao/9781884446054.article.T082145.

Fig. 7 Detail of incised lines marked up over ink drawing. WA1846.152a, Raphael, 'Recto: Study for the Virgin and Child with a book (Virgin of Pasadena).' Image © Ashmolean Museum, University of Oxford.

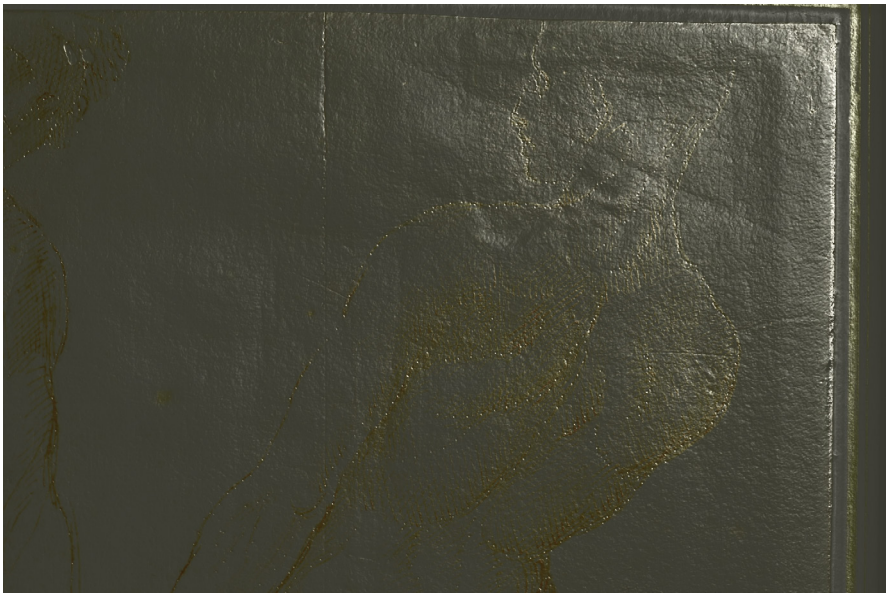

Fig. 8 Detail of pouncing shown in RTI scan. WA1846.173, Raphael, 'Three nude bearers (study for the Entombment).' Image © Ashmolean Museum, University of Oxford.

his knee in the blind stylus version, but in the ink sketch it rests on his lower right side. Prior to viewing with RTI, the extent to which we could see the blind stylus sketches was limited.

Case study 4: WA1846.173, 'Three nude bearers (Study for the Entombment)' (Fig. 8)
Incised lines outline the torso of the body of Christ carried by the three men. As above, the sketched outline is explored and placed, but in this case is not followed up by inked lines. There are a few faint red chalk lines indicating the position of the body, but the more detailed figure worked out in blind stylus remains largely invisible to the naked eye. This could be because while the fully drawn figures bearing the body were pounced for transfer, the placing of the figure of Christ was possibly only important in this sketch as far as the other three figures interact with it, and so did not need to be drawn in ink.

As well as enabling a detailed and in-depth view of incised lines in the surface of the support, RTI allowed an insight into all three-dimensional features, notably giving a particularly enhanced view of pouncing. By removing other visible information with the filters, we acquired beautiful snapshots of how precisely the pouncing outlines the figures and the extent of detail it allowed to be transferred.

Treatment and rehousing
1. Treatment
Once each drawing had been thoroughly examined and a full condition report compiled, a treatment proposal was established. From the beginning of the project the aim was for treatment to be carried out only where absolutely necessary. Most of the drawings were in a stable condition and only housing needed addressing. A very small number needed further treatment and this was carefully considered and discussed in detail with curators. Since only conventional treatment methods were used, largely just removal of the supports from their old mounts and inlays, and in a few instances repairs to the support within or outside areas of iron gall ink,[14] the techniques are not discussed further in this paper.

2. Housing
The Old Master drawings at the Ashmolean are housed in mounts varying widely in age and design. Only a small number have been remounted in recent years. Many of the Raphael drawings were last attended to by Judith Chantry who kept records in her log book[15] when she remounted a drawing. Beyond that, however, there is little record of historic conservation work and it is often impossible to know exactly how old some of the mounts are. We do know that a number of works of art on paper from the collection were mounted at the

14 Repair to breaks in the support caused by corrosion along lines of iron gall ink was undertaken using remoistenable tissue and The Dutch Fe-Migration Mending Test from Practice-in-Conservation to mitigate damage from application. While application followed their recommended approach, tests prior to treatment revealed that using gelatin-coated remoistenable tissue produced a repair with unacceptable shine. After some deliberation, discussion and testing repairs were carried out using a remoistenable tissue of 5gsm tengujo tissue coated in a dilute solution of wheat starch paste/methyl cellulose (1:2 v/v).

15 Judith Chantry, 'Conservation Ledger,' 1975 to 1995.

British Museum in the late nineteenth and early twentieth centuries and among these were some of the Raphael drawings, but there is no clear documentation of this. Furthermore, it is thought that many of the drawings were drummed down after World War II by Mr Florczyk, who was working in the museum as a mount maker, but again there is no written record to be found.

Of the drawings in the project, the support had typically been inlaid into cream paper and housed in mounts which were either solid single sided window mounts, solid double-sided window mounts with acrylic glazing in the verso window or solid double-sided window mounts with the drawing suspended in a 'acrylic sandwich' inside the window aperture, either in an inlay or suspended at the corners by narrow strips of nylon adhered to both support and acrylic. Often where acrylic glazing was used, the drawing was in full contact with it. All of the drawings had a gold wash line either around the window of the mount or of the inlay. In all instances the mounts appeared old and worn, and in a few examples, degraded and brittle.

A period of research at an early stage in the project looked at the best way to house the drawings, taking into consideration limitations dictated by storage, the extent of handling and usage, and factors dictated by the drawings themselves: The mounts needed to conform to standard sizes, allow access to the verso (either by hinging the support into the mount along the top edge, or having an aperture in the verso of the mount) and provide good protection to the support against regular handling and storage in a stack of similar mounts in a solander box. Since storage space is limited the mounts could not be too deep, and regular retrieval requires ease of handling. A particular concern about static from acrylic glazing resulted in a search for an alternative for double-sided mounts. This lead to a research project by Oxford University students to investigate how to mitigate any static from the acrylic glazing within the mount,[16] but unfortunately no workable solution was forthcoming.

Taking everything into consideration, we found that the best current solution was to use standard mounting techniques with a carefully considered approach designed to hold the drawings secure, give as much protection as possible, allow some inevitable movement of the support, while giving as much access as possible. This is described fully below. No wash lines were employed.[17]

i. Inlay

Since as much as possible of the support needs to be seen inside the mount without interruption, inlaying the drawings into suitable paper was required. Historically, the drawings were float mounted with the support drummed down onto the backboard, or inlaid into cream or white paper (usually thicker than the support) using the bevelled edge inlay method. Both of these techniques, however, tend to cause a ridge around the edges of the support from the chamfered edge of the inlay or the 'V' hinge along the edges of the verso required for drumming down. This is particularly problematic when there is a ground on the support, the ridge causing distortion in the paper under the brittle material of the ground resulting in cracking along all edges. Furthermore, both of these methods obscure the verso of the support, the former totally and the latter around the edges, and drawings appear to be held tightly flattened onto the mount allowing little if any movement.

Strip inlaying allows a far more sensitive approach. The tissue bridging the narrow gap between support and inlay allows the paper some independent movement, and because it is thin ensures that any lines, marks or stamps along the edges of the verso remain visible through it. For the Raphael drawings, handmade 100% rag paper was used for the inlays. It was washed and pressed twice to ensure dimensional stability as far as possible. An aperture was then cut and the inlay secured to the support using 5 gsm tengujo tissue adhered with wheat starch paste. Where lines of iron gall ink ran to the edge of the sheet, remoistenable tissue was used.[18]

ii. Mounts

Only a few of the newly inlaid drawings were housed in single-sided mounts. Either these had previously been heavily lined, obscuring any information that might have been had from the verso or using transmitted light, or were single-sided chalk drawings where lifting the sheet posed no structural threat. Most of the drawings being double-sided required double-sided mounts. Having tried and tested alternative methods for housing double-sided works of art on paper, we concluded that currently the most suitable compromise was the traditional model: the overthrow mount with an acrylic window in the verso.[19] After some consideration we decided to slightly adjust this standard model by adding a layer of 550–micron board with

16 Static-Free Transparent Mountings for Fine Art: Team Design Project by materials undergraduates at Oxford University 2016.

17 Gold wash lines were historically used to denote a drawing of particular importance. Arguably, however, the fact that these drawings were working drawings and preparatory sketches makes the presence of such an embellishment misplaced.

18 5 gsm tengujo tissue with a coating of 1:2 v/v wheat starch paste to methylcellulose reactivated with minimal moisture.

19 Joanna M. Kosek, *Conservation Mounting for Prints and Drawings: A Manual Based on Current Practice at the British Museum* (London: Archetype Publications Ltd, 2004), 41–42.

an aperture cut slightly smaller than the verso window beneath the support. Inevitably the support will still sit in contact with the acrylic glazing, but anecdotally by introducing some airflow the likelihood of static should be reduced. Furthermore this additional layer covers the sharp edges of the acrylic glazing thus giving protection from possible abrasion.

The character of the paper used by Raphael makes some dimensional movement of it inevitable. Thus by releasing the supports from the restraint of being drummed down or inlaid into heavy paper some undulation or bowing developed in every support. Even for the chalk drawings which could be humidified and pressed, this natural undulation proved to be an inherent characteristic and had to be considered when thinking about how to mount the drawings safely.

All the drawings now have a 2200–micron Heritage Museum Board window mount around the recto, giving some depth for planar distortion. However to mitigate undulation we decided that some restraint was required which would also avoid future excessive movement of the support that would cause it to bow out of the mount. We also wanted to find a way to prevent any flexing of the support which might put stress on areas weakened by iron gall ink corrosion and induce cracking. Because the verso window in the mount makes the verso accessible (and therefore lifting the support unnecessary), we decided the best solution was to attach the drawings along all edges to the backboard of the mount. To do this we attached Japanese tissue strips along every edge of the inlay and adhered these strips with wheat starch paste directly to the backboard of the mount leaving a gap between the edge of the inlay paper and the area of adhesion.[20] This was designed to hold the support as flat and secure as possible and to restrict undulation to a point, but still allow some movement where necessary. The fault lines of weaker tissue both between support and inlay and the un-adhered part of the tissue strips are intended to guard against putting undue stress on weaker areas of the support.

Further adjustments were necessary for two drawings where undulation was more pronounced: An internal window, cut slightly larger so as not to be seen, was attached to the inside of the recto window to give extra depth. And for a particularly fragile drawing with extensive damage from iron gall ink corrosion, the recto window of the double-sided mount was adhered to the backboard, making it into a solid mount that is less likely to flex.

20 16 gsm uso mino tissue was used, lighter and weaker than the inlay paper but thick enough to provide some restraint.

Conclusion

As a collection, the drawings examined in the project are working drawings: sketches and studies that work through ideas and demonstrate technique. They were created as a means of working towards the "greater" art form, the painting. These drawings were evidently prized from the beginning, and certainly over the years have become extremely highly valued and well-known.

Through careful and detailed examination of the drawings our understanding of just how they were made and how subsequent treatment of them has affected their condition and appearance has significantly deepened. Our insight into just how extensively Raphael used blind stylus and how faint this has become (in some cases now only visible by zooming in to RTI images) was a particular revelation. It is quite possible that the incisions made by the stylus could have been reduced by historic conservation treatment such as humidification, pressing or drumming down with moisture. It is extremely important therefore to understand how potential treatment might affect the clarity of these marks, which are as important a part of the working process as the ink sketches themselves, and act to preserve them wherever possible.

By making detailed records of our observations we hope to have created a bank of information that subsequent study and treatment can refer to without having to re-examine the drawings themselves directly for the information. This information should be available as a link from the Ashmolean website in the near future.

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Biography
Alexandra Greathead is the Senior Conservator of Works of Art on Paper at the Ashmolean Museum of Art and Archaeology, University of Oxford. She studied conservation at Camberwell College of Arts and Northumbria University. This included an internship at the Harry Ransom Centre, University of Texas. The materials and drawing techniques of Raphael are research interests within a wider context of studying the works of art on paper by Italian Old Masters.

Lara Daniels is a Conservator of Works of Art on Paper at the Ashmolean Museum of Art and Archaeology, University of Oxford. She studied an MA in conservation at Camberwell College of Arts having completed an MA in History of Art at Edinburgh University. Lara works across the collection at the Museum.

Beth Twinn is a Conservator of Works of Art on Paper at the Ashmolean Museum of Art and Archaeology, University of Oxford. She studied conservation at Camberwell College of Arts. Beth's main focus is on Islamic and Indian works on paper though she has knowledge and experience across the collections. Before joining the Ashmolean, Beth worked at the Museum of Islamic Art in Qatar.

Materials & suppliers
Dutch Fe-Migration Mending Test Kit from Practice-in-Conservation.

Acrylic glazing
1 mm–thick cast Perspex
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100% rag papers
Queen Anne handmade book paper; 65 gsm pale wove, pale laid, dark wove and dark laid papers; made by Ruscombe Mill
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Griffen Mill handmade paper; 80gsm Merlin, 80gsm Genet
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Japanese tissue
5 gsm tengujo tissue, 12 gsm tengujo tissue, 16 gsm Uso Mino tissue, 23 gsm Kozu Shi tissue. Supplied by John Purcell Paper.

Mount board
Heritage Museum Board; cream, 2200 micron, 1650 micron and 1100 micron. Supplied by John Purcell Paper.

Adhesives
Starch from wheat. Manufactured by BDH.
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Methyl cellulose. Manufactured by BDH, supplied by VWR International Ltd.

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