Rachel Arnold

Portfolio of practical work and documentation of
stained glass conservation and production

Contents

Profile

For several years I have actively pursued a career in conservation – specifically working with historic stained glass – through study, voluntary and paid work. I have a Masters degree in Stained Glass Conservation and Heritage Management and a wealth of practical experience working with historic objects, artefacts and buildings, and currently work as a conservation assistant for the National Trust. In addition to this I am able to produce written work, including conservation reports, to a high standard and conduct research on stained glass and other historic artefacts to a strict deadline. I strive to work and train as part of a skilled team to promote the public understanding and enjoyment of historic stained glass, and to conserve and protect it across the UK. I am used to working in historic buildings and understand the resulting restraints; adapting my approach to achieve the required outcome but respecting the original fabric. I am practical and hands-on, with a great deal of skill, concentration and hand-eye coordination, working with fragile historic objects.

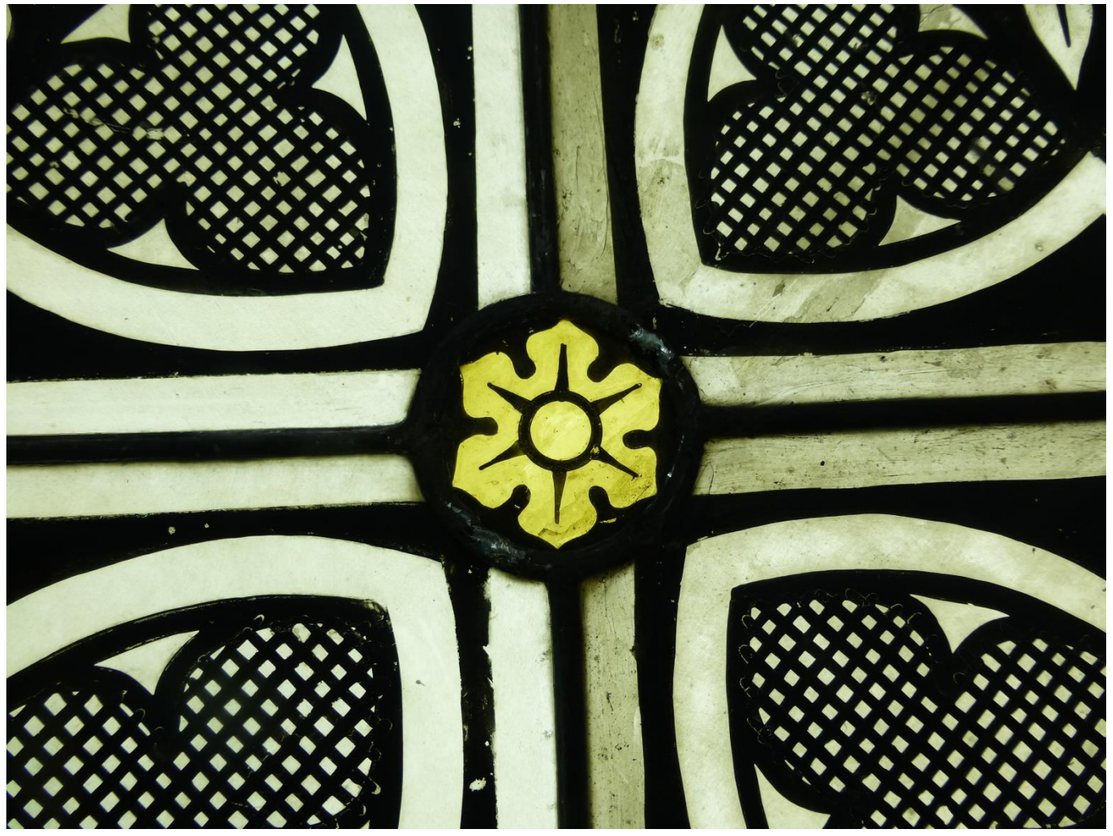
My practical conservation experience – referred to throughout this portfolio – has been gained working in workshops and on site for Martin Johnson Stained Glass Conservation Studio, York and Derix Glasstudios, Taunusstein, as well as in practical projects for my MA. This experience spans all areas of stained glass production and conservation.

I have a thorough understanding of conservation theory, ethics and approaches and keep abreast of current trends and recent discoveries in the professional stained glass world. I also have a broad knowledge of the degradation phenomena of glass and its decorative surfaces, based on its physical composition and the effects of its environment. I have completed numerous written assessments including conservation reports and a 20,000-word dissertation, exploring the condition and conservation procedures of specific glass panels and windows. I relish the opportunity to expand my skills and abilities with the training and experience offered by this role.

Practical Conservation

Cleaning - Mechanical

This fourteenth-century panel had a lot of surface dirt including dust, cement and paint splatters. I removed these deposits using brushes and a scalpel under a microscope. Dry methods (mechanical cleaning) were used and not wet methods (chemical cleaning) because the panel had a variety of glass from different ages showing various signs of corrosion. (MA: Head panel St. George, 883040681.4, from the Parish Church of St. Peter, Barton-Upon-Humber – April 2014).



This image captures a detail of a section of a nineteenth century window half way through the removal of extensive layers of surface dirt on the surface. Thick layers of silicone were applied to this panel in a previous intervention with a view to protect the paint and glass. This material attracts dirt and promotes degradation of the glass so must be removed. During the mechanical cleaning phase of this project I meticulously removed layers of silicone from multiple panels using a scalpel and smoke sponges. (Derix: Panel Sakr. II 6a, Church of St. George, Eggstätt, Germany – June 2013).

Cleaning – Chemical

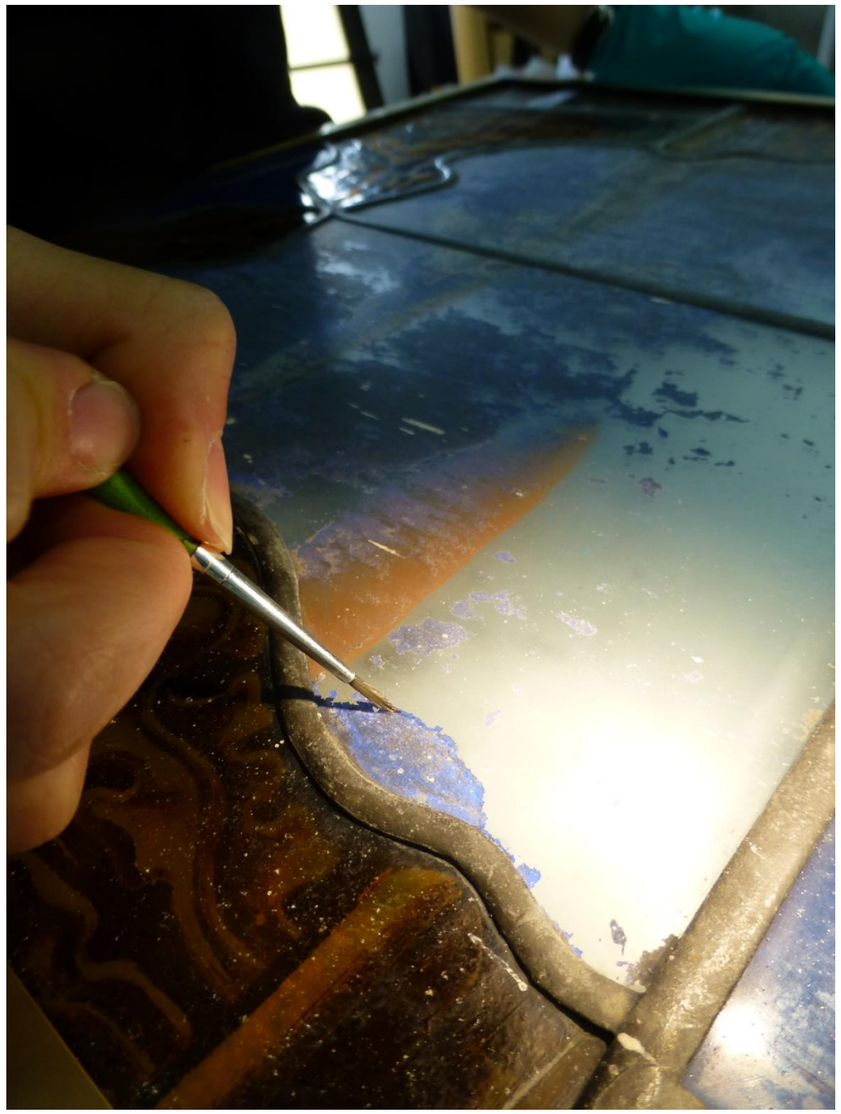
Above is a detail of a nineteenth-century painted stained glass panel with widespread microbiological growth. Infestations of microbes on glass can cause chemical changes in its surface composition and encourage moisture on the glass which is hugely damaging. Steps must be taken to remove and kill all living organisms on the glass. Two thorough applications of ethanol, over a forty-eight hour period effectively and safely inhibit microbial growth. This is done under a vacuum, whilst wearing masks to discourage the spread and inhalation of the spores and after assessment of the glass, ensuring it will withstand such chemical treatment. (Derix: Panel nII 7b, Church of St. George, Eggstätt, Germany – June 2013).

The panel above has an adhesive label which has been in place for a number of years, as well as other adhesive residues from tape. After inspection it was clear that the label could not easily be removed so a fume chamber, using cotton wool soaked in acetone was created. This method safely loosened the adhesive bonds and allowed the label to peel off the glass surface without causing damage. Creating such a chamber was the safest way to treat the glass which has a fragile and corroded surface, allowing the effects of the chemical to work while not coming into direct contact with the glass surface. (MA: Head panel St. George, 883040681.4, from the Parish Church of St. Peter, Barton-Upon-Humber – April 2014).

Panel nIII 1a before cleaning in Derix Glasstudio, Taunusstein.
This panel dates from 1880-1890 and is from the church of St. George in Eggstätt, Germany. It has various accretions on its front and back surfaces which could cause degradation, including silicone, mortar, rust, paint and putty – June 2013.

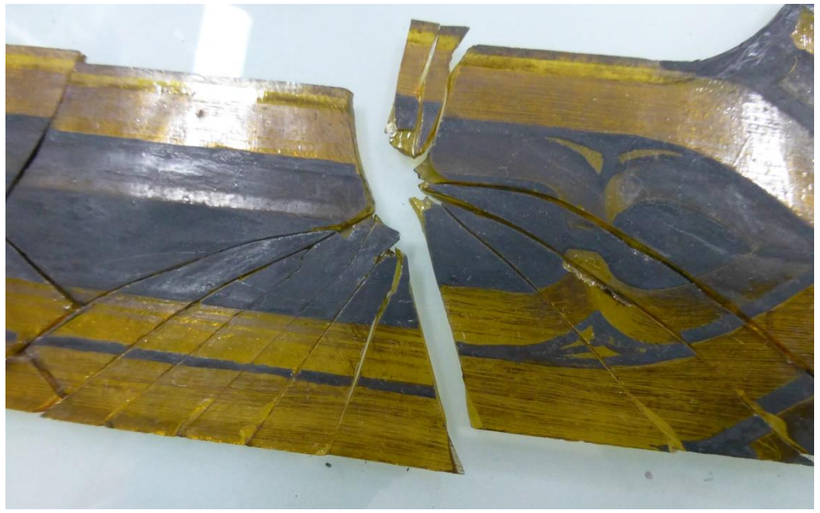
Panel nIII 1a after cleaning in Derix Glasstudio, Taunusstein.
The surface accretions were removed using both mechanical and chemical methods. The majority of the silicone, paint and putty could be removed using mechanical methods, but the harder deposits of mortar and rust needed ethanol mixed 50:50 with distilled water – June 2013.

Paint Consolidation



Detail of panel sIII 4b receiving a treatment of paint consolidation. Some of the panels in the church of St. George, Eggstätt had originally been put in backwards, which has caused largescale loss of paint. Consolidating the paint with a mixture of Paraloid B72 and ethylacetat prevents against further loss of paint. The mixture is applied to the edges of the paint layers. It is possible after the surviving original paint has been preserved to fill in some of the lost painted details on the reverse side with cold paint. (Derix: Panel sIII 4b, Church of St. George, Eggstätt, Germany – June 2013).

Edge Bonding



This piece has suffered impact damage and completely shattered, but thankfully due to the large amounts of silicone applied to its surface, all of the pieces remain to fix together again. (Derix: Panel nIII 6a, Church of St. George, Eggstätt, Germany – June 2013).

Here the broken piece has been taped and edge bonded. The adhesive residue still needs to be thinned and cleaned from the surface but the piece has been successfully reassembled. (Derix: Panel nIII 6a, Church of St. George, Eggstätt, Germany – June 2013).

This damaged piece of glass has a piece missing from the middle of the break. I have edge bonded the crack and inserted a larger amount of epoxy resin into the hole to form an araldite infill. (Derix: Panel nIII 1b, Church of St. George, Eggstätt, Germany – June 2013).

I am using Araldite 50:50 to bond breaks in a nineteenth-century panel. Before bonding it is essential to make sure the crack is completely clean and it is also important to remove excess araldite after the bond has dried. (Derix: Panel Sakr. II 5a, Church of St. George, Eggstätt, Germany – June 2013).

Glass Infills

These unpainted panels consist entirely of circles and triangles of mouth-blown glass in a repeating pattern. I was required to create a number of glass infills to replace broken pieces in the panels. I removed the broken glass, cleaned the dried putty and cement from the lead, cut new glass pieces from matching glass and inserted them into the spaces. I then used putty and solder to secure them in pace. This panel required three pieces in a row to be inserted. (Derix: Panel 13/3, Church of the Holy Cross, Deggingen, Germany – July 2013).

This set of unpainted glass panels were in very poor condition. The one pictured, had a broken piece of glass which need replacing in the centre of the panel. In order to remove the existing glass and insert new glass I had to carefully raise the lead flanges, then replace and solder them once the new glass was in place. (Derix: Panel G1/3, Church of St. Valentine, Kiedrich, Germany – May 2013).

Nineteenth century tracery panel before conservation work
This quatrefoil tracery panel had several pieces missing while still *in situ* as well as two undecorated and ill-fitting pieces have been inserted into the panel (the clear glass and the read glass). It has cracks in some places, putty or cement failure and breaks in the lead, which has caused the whole panel to break in half. There is also a lot of surface dirt. (Derix: Panel Sakr. 14AB, Church of St. George, Eggstätt, Germany – June 2013).

Nineteenth-century panel after the insertion of painted glass infills.
It was possible to recreate the infills on yellow glass with a painted floral design copied from the surviving material in this panel and in another window. It was agreed that the unpainted red and clear glass pieces should be replaced because they are ill-fitting. Evidence for the design of these sections was found in another window. The remaining triangle of missing glass (top right) will contain a painted araldite infill, because the area was considered to be too small to effectively recreate with glass. (Derix: Panel Sakr. 14AB, Church of St. George, Eggstätt, Germany – June 2013).

Panel nIII 8b (church of St. George, Eggstätt) before conservation.
The panel contains a thin piece of blue glass which was inserted to replace a missing area in the cloak. This shattered whilst removing the panel from its window opening. Like the inserts in the previous example, the glass was ill-fitting and had been inserted *in situ.* It shattered for these reasons, along with it being a very thin piece of glass. (Derix: Panel nIII 8b, Church of St. George, Eggstätt, Germany – May 2013).

Panel nIII 8b (church of St. George, Eggstätt) after conservation.
The newly inserted piece of glass was matched to the topmost original pieces in the cloak, not the one directly above it, which is another later inserted piece. It was painted based on the style of the cloak and lines flowing from the other areas in the panel to create a whole composition (Derix: Panel nIII 8b, Church of St. George, Eggstätt, Germany – May 2013).

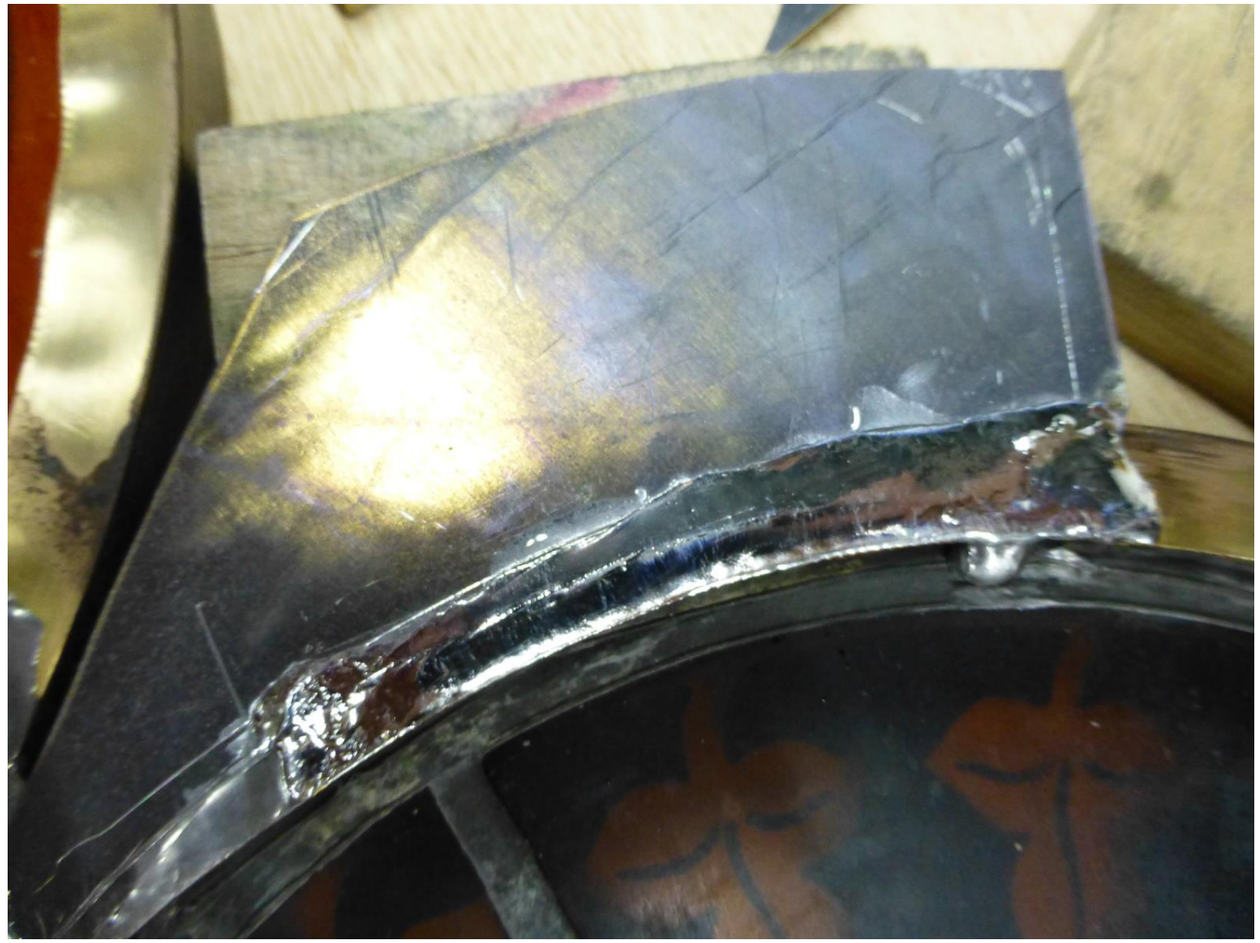
Soldering and Mending Leads

These panels all had to be framed in a thin U-profile frame made from steel, which had to be soldered to the lead. This posed some difficulties because the melting point of lead is much lower than steel so great care had to be taken not to melt the lead, but get the steel hot enough for the solder to stick to it. In some places I had to introduce lead infills over small gaps in the panel. The previous lead frame, which was wider than the new steel one would have covered these gaps. (Derix: Panel 13/4, Church of the Holy Cross, Deggingen, Germany – July 2013).

In this example I have inserted a short mending lead and soldered it to the existing lead which was missing a section, due to physical damage. Also visible in this image is a re-soldered break in the lead at the top. I have polished the new solder joints and managed to blend them in with the surrounding old lead. (MA: Head panel St. George, 883040681.4, from the Parish Church of St. Peter, Barton-Upon-Humber – April 2014).

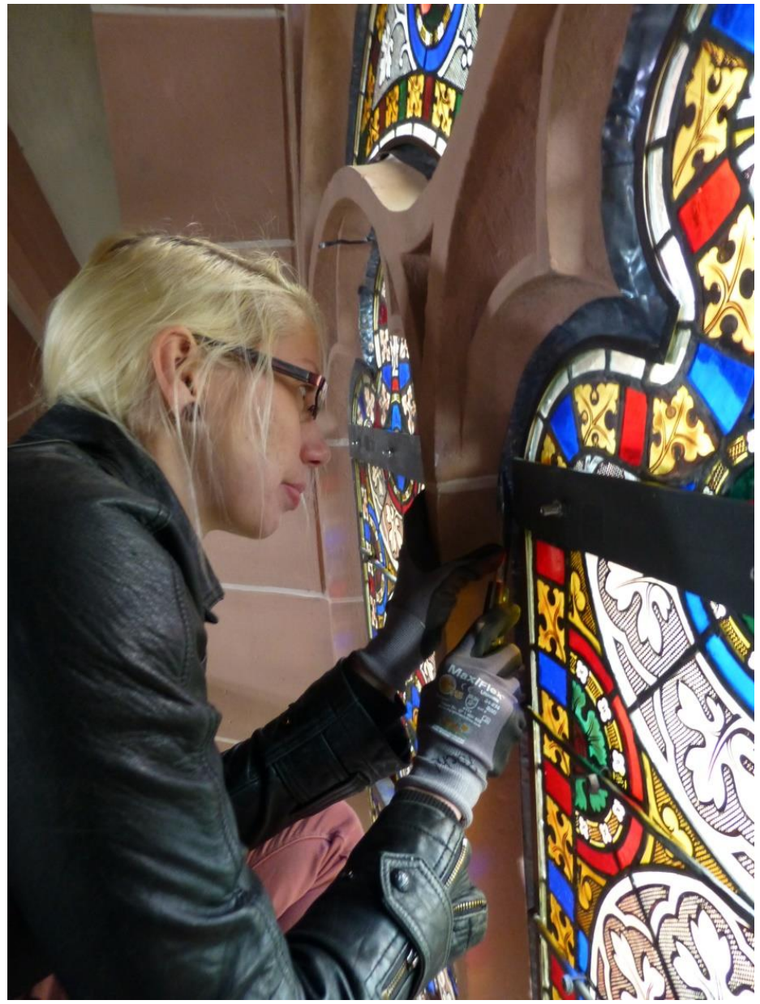
Framing

After I attached the custom-made brass U-profile frame around each panel, I was required to solder a lead border in place. This border effectively seals the panel in its window opening and can be adjusted to allow the correct ventilation of air through the ventilated protective glazing system. (Derix: Tracery panel, Church of St. George, Eggstätt, Germany – July 2013).



I had to cut the lead to size and solder it on the brass frame. It was essential not use to much heat, which could cause the lead to melt and the frame to come apart. Also it was important to create a very smooth finish; otherwise it may not fit tightly in its window opening. (Derix: Tracery panel, Church of St. George, Eggstätt, Germany – July 2013).

Protective Glazing



Working on site at the church of St. Valentine in Kiedrich, Germany to adjust the lead border around the framed stained glass panels. This will be done accordingly at the top and bottom of each light to ensure the optimal amount of ventilation in the protective glazing system. The system will be reassessed after several months to ensure it is working well to ensure minimal levels of surface condensation on the original glass. (Derix: Window nIV, Church of St. Valentine, Kiedrich, Germany – May 2013).

Stained Glass Production

Finished Pieces

The above panel was created in the Summer of 2012 during my work experience at Martin Johnson Glass Conservation studio. I carried out all stages of the production: from design, glass cutting, painting, leading, soldering and cementing the panel. Although the panel was not intended to be put up in a window opening I carried out thorough waterproofing techniques – June 2012.

I made this panel in October 2012 at the start of my MA. I experimented with different patterns in glass painting and used silver stain to create the face of the lion, scratching out its eyes and teeth before firing. The style of the lion is medieval, based on one found in a book. It uses putty as a sealant.

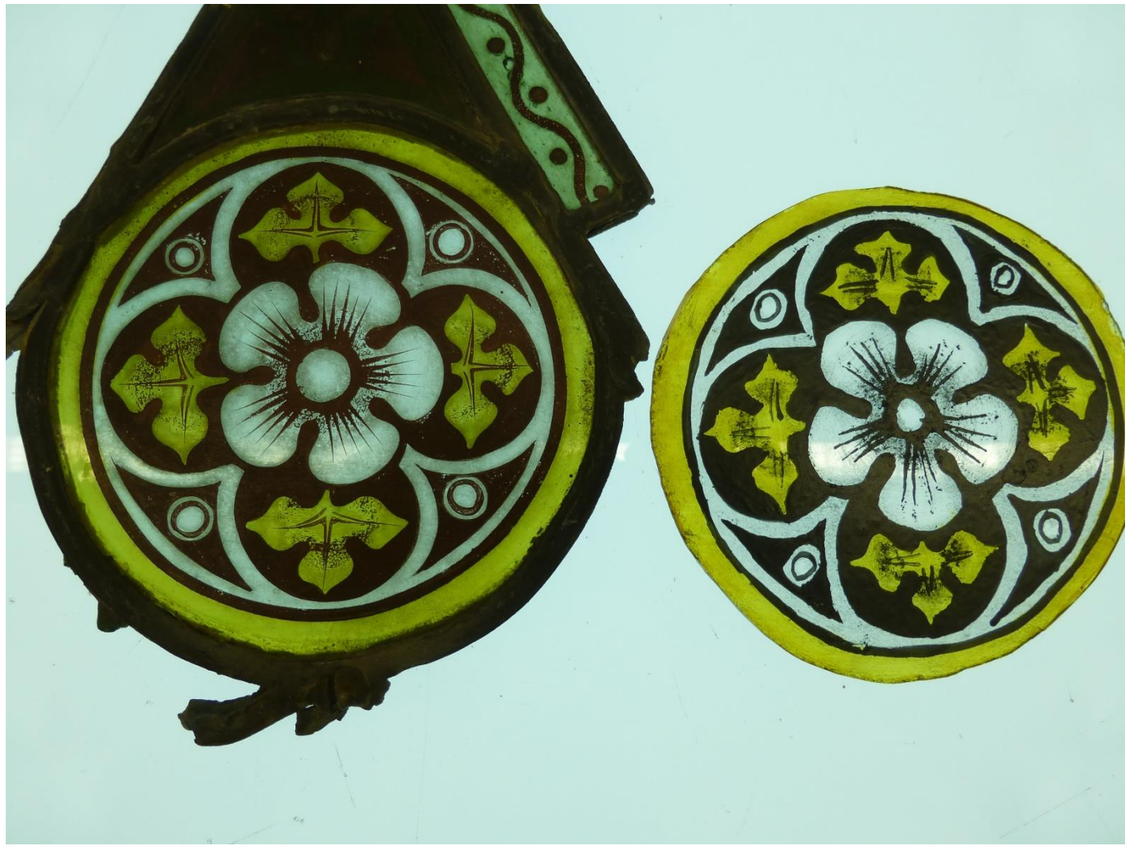
I cut and leaded up this plain glass, quarry panel using cement to weatherproof it. Care was taken to lead the quarries in the optimal way, leaving no fragile or weak areas in the structure – October 2012.

Glass Cutting

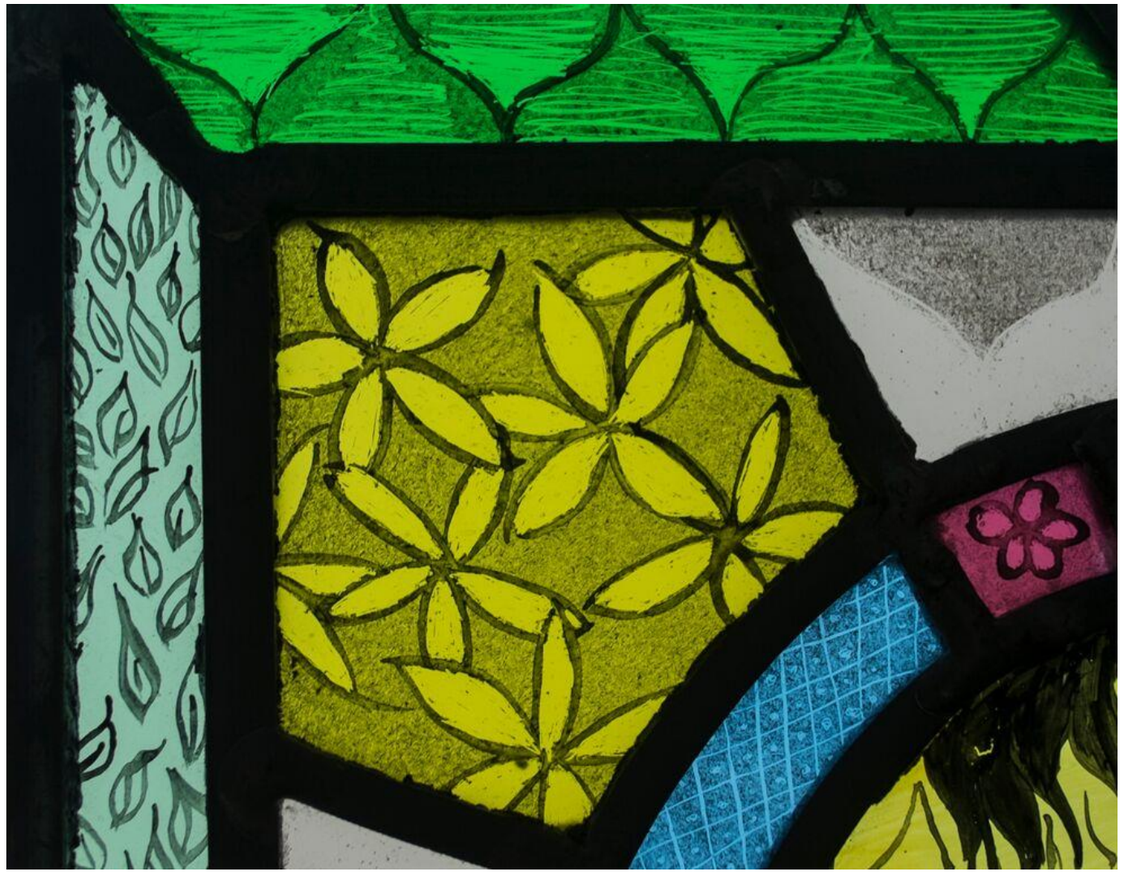
I have experimented cutting complex shapes such as circles (above left) and curved edges like in the rainbow (above right).

Painting and staining

I have attended Jonathan Cook's two-day glass painting course (see overleaf for certificate)



As part of my technical training in glass painting and observation for my MA, I was required to select a piece of painted glass and copy the design from it on to another piece. The piece chosen uses silver stain and black paint in a design based around a quatrefoil with a flower in. It probably formed part of a canopy and is likely to be nineteenth-century, imitating medieval glass. The copy required several applications of paint and firings to get the correct pattern and stain in the right places. The final effect works particularly well and was an excellent test in interpretation and glass painting skill – November 2012.

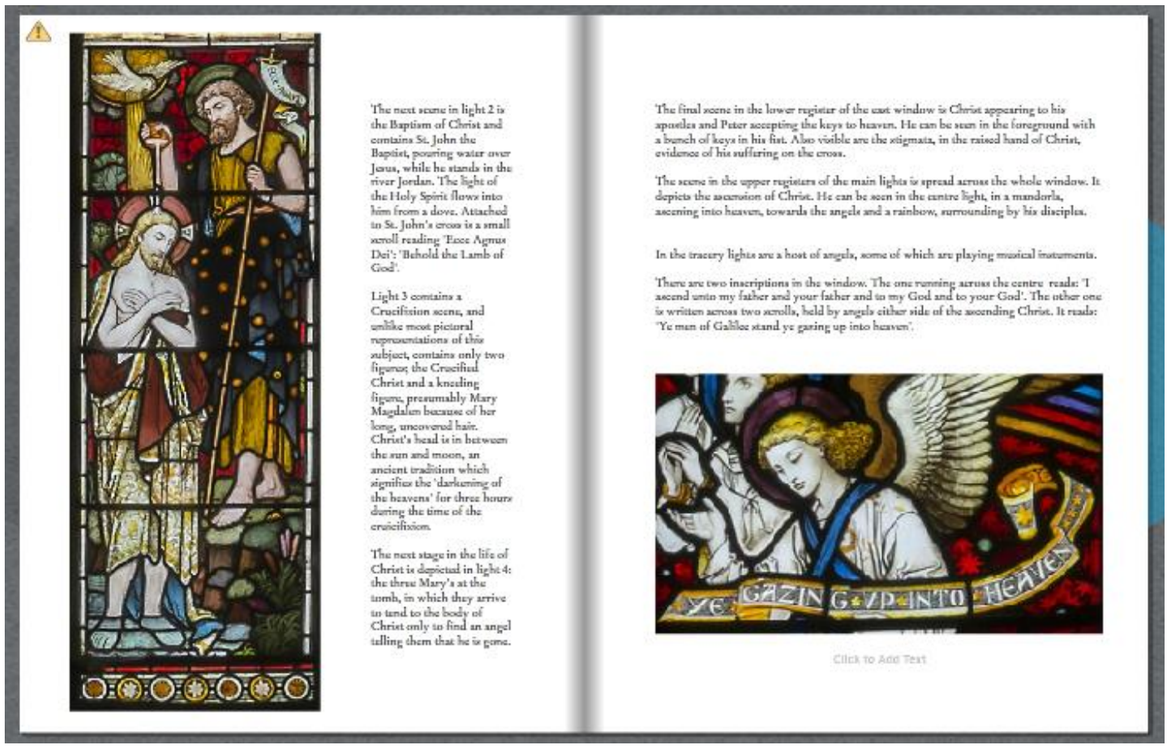


This section of painting is a detail of my panel with a lion's head in the centre (pictured above). Using black vitreous paint I have experimented with different glass painting techniques including wash, stippling, scratching away and line drawing, to create complex designs which come together to make a final, decorative piece – October 2012.

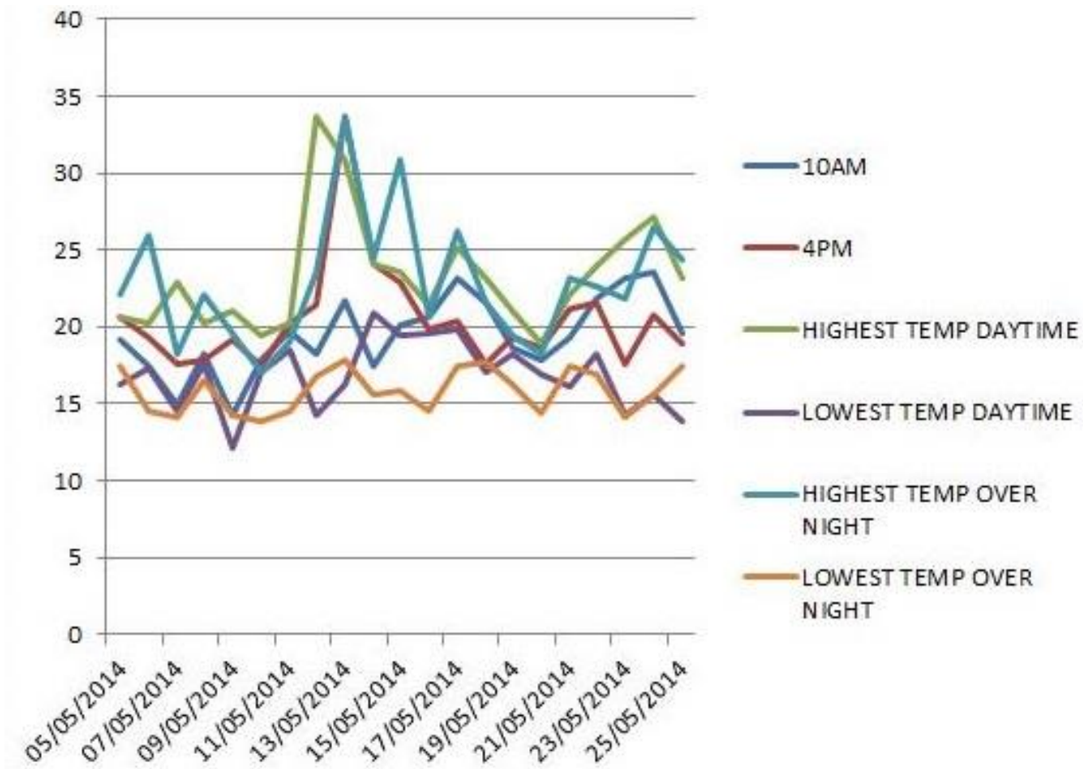
Documentation

Full examples of some of my written work are available to view on my webpage: http://www.raconservation.co.uk/library/

Research

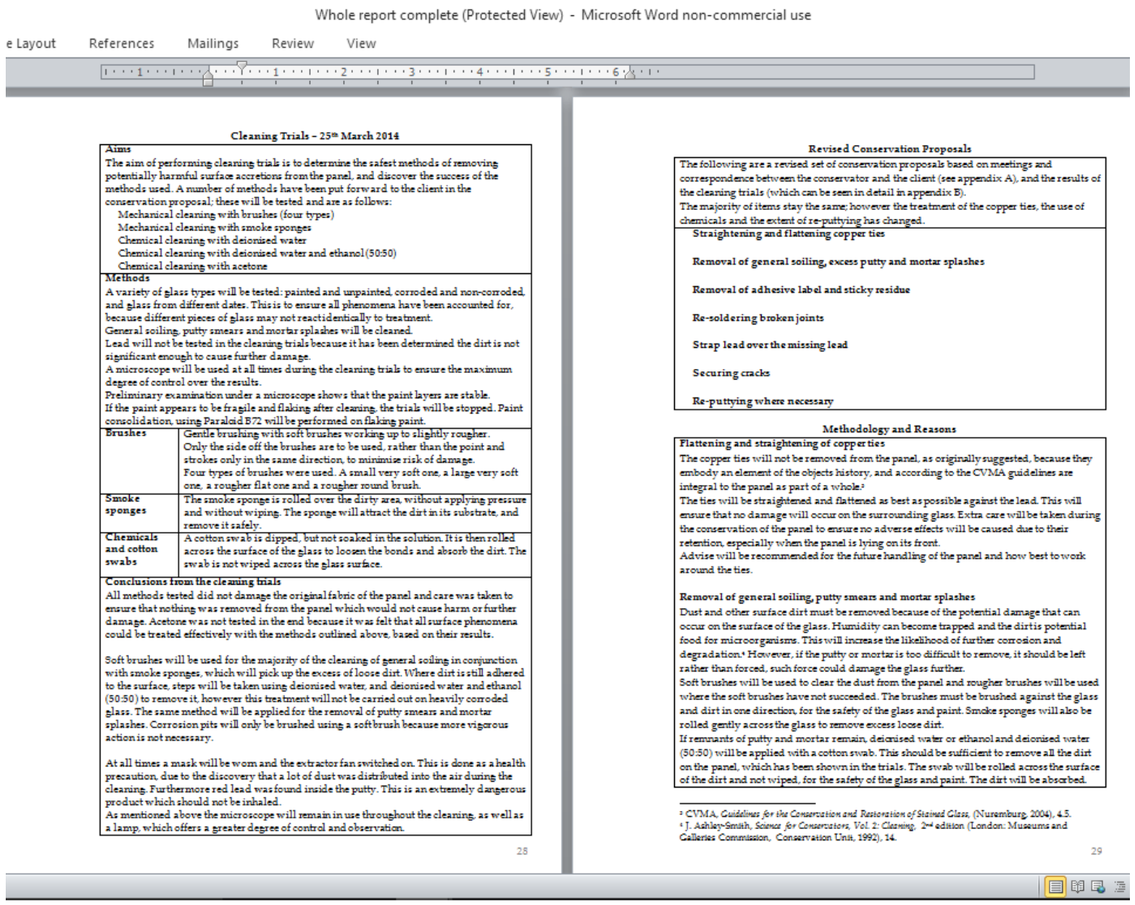


The image above is a screen shot from an online book I am producing about the stained glass of All Saints church, Stamford in Lincolnshire. The glass is mostly nineteenth-century, has previously never been written about or researched and has limited archival and documentary information pertaining to its insertion. I have thus performed a great deal of research into its historical background and origin, including artist, patrons and date, with the view to making a book for publication – August 2015.



As part of my dissertation for my MA I carried out research into the history and an assessment of the environment of the stained glass of Holy Trinity, Goodramgate in York. This was done in order to produce a condition assessment and to determine a statement of significance for the glass. Above is a graph displaying my findings for the temperatures over a specific time period – May 2014.

Report Writing



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Cleaning Trials – 25th March 2014

Aims

The aim of performing cleaning trials is to determine the safest methods of removing potentially harmful surface accretions from the panel, and discover the success of the methods used. A number of methods have been put forward to the client in the conservation proposal; these will be tested and are as follows:

- Mechanical cleaning with brushes (four types)
- Mechanical cleaning with smoke sponges
- Chemical cleaning with deionised water
- Chemical cleaning with deionised water and ethanol (50:50)
- Chemical cleaning with acetone

Methods

A variety of glass types will be tested: painted and unpainted, corroded and non-corroded, and glass from different dates. This is to ensure all phenomena have been accounted for, because different pieces of glass may not react identically to treatment.
General soiling, putty smears and mortar splashes will be cleaned.
Lead will not be tested in the cleaning trials because it has been determined the dirt is not significant enough to cause further damage.
A microscope will be used at all times during the cleaning trials to ensure the maximum degree of control over the results.
Preliminary examination under a microscope shows that the paint layers are stable.
If the paint appears to be fragile and flaking after cleaning, the trials will be stopped. Paint consolidation, using Paraloid B72 will be performed on flaking paint.

Brushes	Gentle brushing with soft brushes working up to slightly rougher. Only the side off the brushes are to be used, rather than the point and strokes only in the same direction, to minimise risk of damage. Four types of brushes were used. A small very soft one, a large very soft one, a rougher flat one and a rougher round brush.
Smoke sponges	The smoke sponge is rolled over the dirty area, without applying pressure and without wiping. The sponge will attract the dirt in its substrate, and remove it safely.
Chemicals and cotton swabs	A cotton swab is dipped, but not soaked in the solution. It is then rolled across the surface of the glass to loosen the bonds and absorb the dirt. The swab is not wiped across the glass surface.

Conclusions from the cleaning trials

All methods tested did not damage the original fabric of the panel and care was taken to ensure that nothing was removed from the panel which would not cause harm or further damage. Acetone was not tested in the end because it was felt that all surface phenomena could be treated effectively with the methods outlined above, based on their results.

Soft brushes will be used for the majority of the cleaning of general soiling in conjunction with smoke sponges, which will pick up the excess of loose dirt. Where dirt is still adhered to the surface, steps will be taken using deionised water, and deionised water and ethanol (50:50) to remove it, however this treatment will not be carried out on heavily corroded glass. The same method will be applied for the removal of putty smears and mortar splashes. Corrosion pits will only be brushed using a soft brush because more vigorous action is not necessary.

At all times a mask will be worn and the extractor fan switched on. This is done as a health precaution, due to the discovery that a lot of dust was distributed into the air during the cleaning. Furthermore red lead was found inside the putty. This is an extremely dangerous product which should not be inhaled.
As mentioned above the microscope will remain in use throughout the cleaning, as well as a lamp, which offers a greater degree of control and observation.

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Revised Conservation Proposals

The following are a revised set of conservation proposals based on meetings and correspondence between the conservator and the client (see appendix A), and the results of the cleaning trials (which can be seen in detail in appendix B).
The majority of items stay the same; however the treatment of the copper ties, the use of chemicals and the extent of re-puttying has changed.

Straightening and flattening copper ties

Removal of general soiling, excess putty and mortar splashes

Removal of adhesive label and sticky residue

Re-soldering broken joints

Strap lead over the missing lead

Securing cracks

Re-puttying where necessary

Methodology and Reasons

Flattening and straightening of copper ties

The copper ties will not be removed from the panel, as originally suggested, because they embody an element of the objects history, and according to the CVMA guidelines are integral to the panel as part of a whole.[2]
The ties will be straightened and flattened as best as possible against the lead. This will ensure that no damage will occur on the surrounding glass. Extra care will be taken during the conservation of the panel to ensure no adverse effects will be caused due to their retention, especially when the panel is lying on its front.
Advise will be recommended for the future handling of the panel and how best to work around the ties.

Removal of general soiling, putty smears and mortar splashes

Dust and other surface dirt must be removed because of the potential damage that can occur on the surface of the glass. Humidity can become trapped and the dirt is potential food for microorganisms. This will increase the likelihood of further corrosion and degradation.[4] However, if the putty or mortar is too difficult to remove, it should be left rather than forced, such force could damage the glass further.
Soft brushes will be used to clear the dust from the panel and rougher brushes will be used where the soft brushes have not succeeded. The brushes must be brushed against the glass and dirt in one direction, for the safety of the glass and paint. Smoke sponges will also be rolled gently across the glass to remove excess loose dirt.
If remnants of putty and mortar remain, deionised water or ethanol and deionised water (50:50) will be applied with a cotton swab. This should be sufficient to remove all the dirt on the panel, which has been shown in the trials. The swab will be rolled across the surface of the dirt and not wiped, for the safety of the glass and paint. The dirt will be absorbed.

[2] CVMA, *Guidelines for the Conservation and Restoration of Stained Glass*, (Nuremburg, 2004), 4.5.
[4] J. Ashley-Smith, *Science for Conservators, Vol. 2: Cleaning*, 2nd edition (London: Museums and Galleries Commission, Conservation Unit, 1992), 14.

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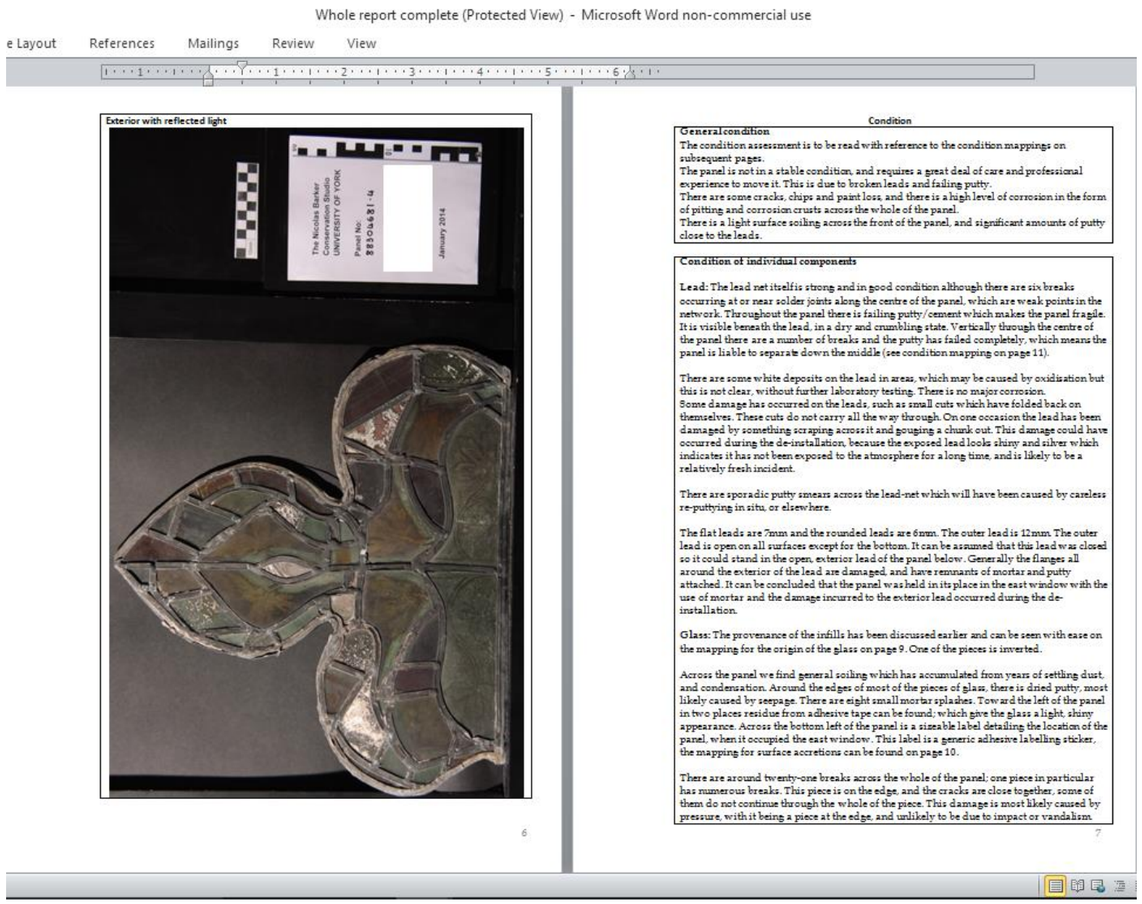

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Exterior with reflected light

6

Condition

General condition

The condition assessment is to be read with reference to the condition mappings on subsequent pages.
The panel is not in a stable condition, and requires a great deal of care and professional experience to move it. This is due to broken leads and failing putty.
There are some cracks, chips and paint loss, and there is a high level of corrosion in the form of pitting and corrosion crusts across the whole of the panel.
There is a light surface soiling across the front of the panel, and significant amounts of putty close to the leads.

Condition of individual components

Lead: The lead net itself is strong and in good condition although there are six breaks occurring at or near solder joints along the centre of the panel, which are weak points in the network. Throughout the panel there is failing putty/cement which makes the panel fragile. It is visible beneath the lead, in a dry and crumbling state. Vertically through the centre of the panel there are a number of breaks and the putty has failed completely, which means the panel is liable to separate down the middle (see condition mapping on page 11).

There are some white deposits on the lead in areas, which may be caused by oxidisation but this is not clear, without further laboratory testing. There is no major corrosion.
Some damage has occurred on the leads, such as small cuts which have folded back on themselves. These cuts do not carry all the way through. On one occasion the lead has been damaged by something scraping across it and gouging a chunk out. This damage could have occurred during the de-installation, because the exposed lead looks shiny and silver which indicates it has not been exposed to the atmosphere for a long time, and is likely to be a relatively fresh incident.

There are sporadic putty smears across the lead-net which will have been caused by careless re-puttying in situ, or elsewhere.

The flat leads are 7mm and the rounded leads are 6mm. The outer lead is 12mm. The outer lead is open on all surfaces except for the bottom. It can be assumed that this lead was closed so it could stand in the open, exterior lead of the panel below. Generally the flanges all around the exterior of the lead are damaged, and have remnants of mortar and putty attached. It can be concluded that the panel was held in its place in the east window with the use of mortar and the damage incurred to the exterior lead occurred during the de-installation.

Glass: The provenance of the infills has been discussed earlier and can be seen with ease on the mapping for the origin of the glass on page 9. One of the pieces is inverted.

Across the panel we find general soiling which has accumulated from years of settling dust, and condensation. Around the edges of most of the pieces of glass, there is dried putty, most likely caused by seepage. There are eight small mortar splashes. Toward the left of the panel in two places residue from adhesive tape can be found; which gave the glass a light, shiny appearance. Across the bottom left of the panel is a sizeable label detailing the location of the panel, when it occupied the east window. This label is a generic adhesive labelling sticker, the mapping for surface accretions can be found on page 10.

There are around twenty-one breaks across the whole of the panel; one piece in particular has numerous breaks. This piece is on the edge, and the cracks are close together, some of them do not continue through the whole of the piece. This damage is most likely caused by pressure, with it being a piece at the edge, and unlikely to be due to impact or vandalism.

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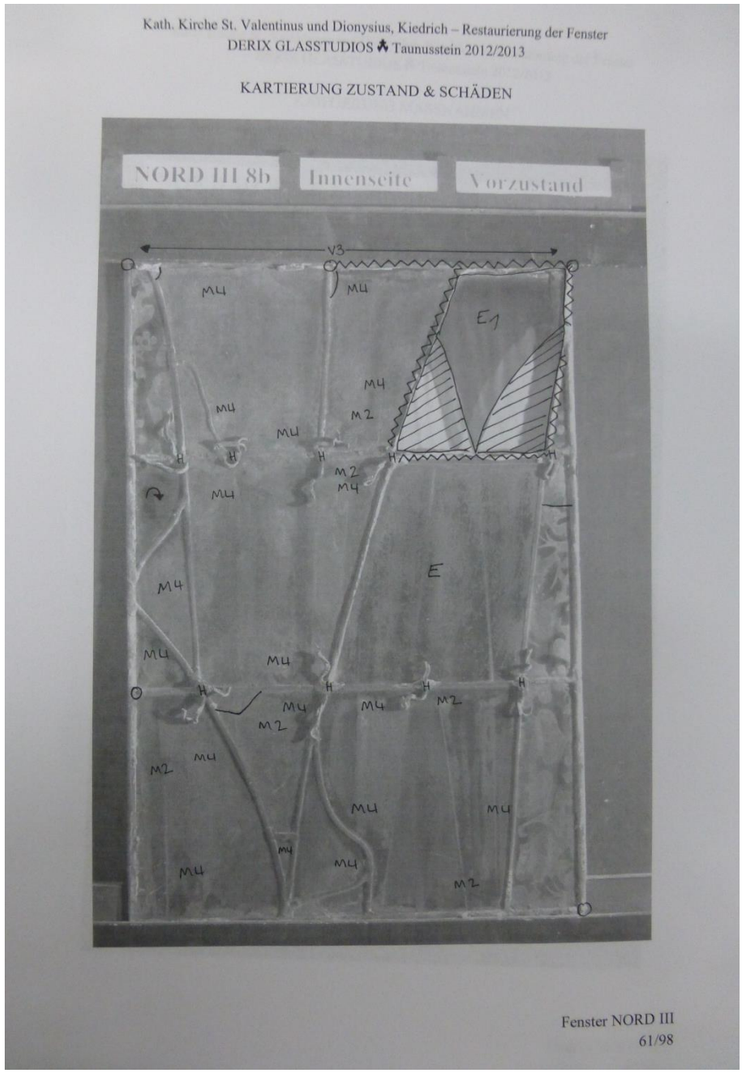
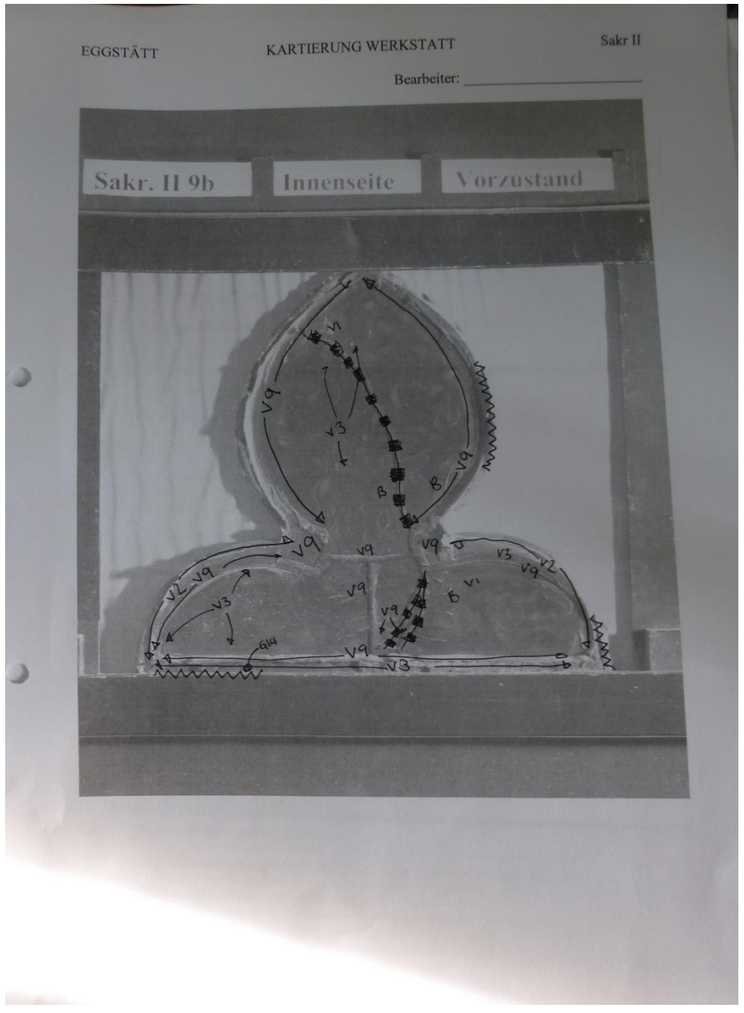
I have written many reports of varying types throughout my professional career, from condition and conservation to accidental damage and historical significance. Some of these have been carried out during my MA at York University and include condition and conservation reports, historical research and statements of significance. Above are sections of a conservation report for a stained glass panel in the care of English Heritage, from the church of St. Peter, Barton-upon-Humber. In my role as a conservation assistant with the National Trust I perform collections audits and conservation reports on the collections held in historic houses and also accidental damage reports. As a volunteer with the Churches Conservation Trust, I visit various churches assessing the environmental condition of churches and their artefacts, including stained glass windows and bringing areas of concern to the attention of conservation management – May 2014.

All reports are written and communicated using appropriate and clear language and presented in a professional manner.

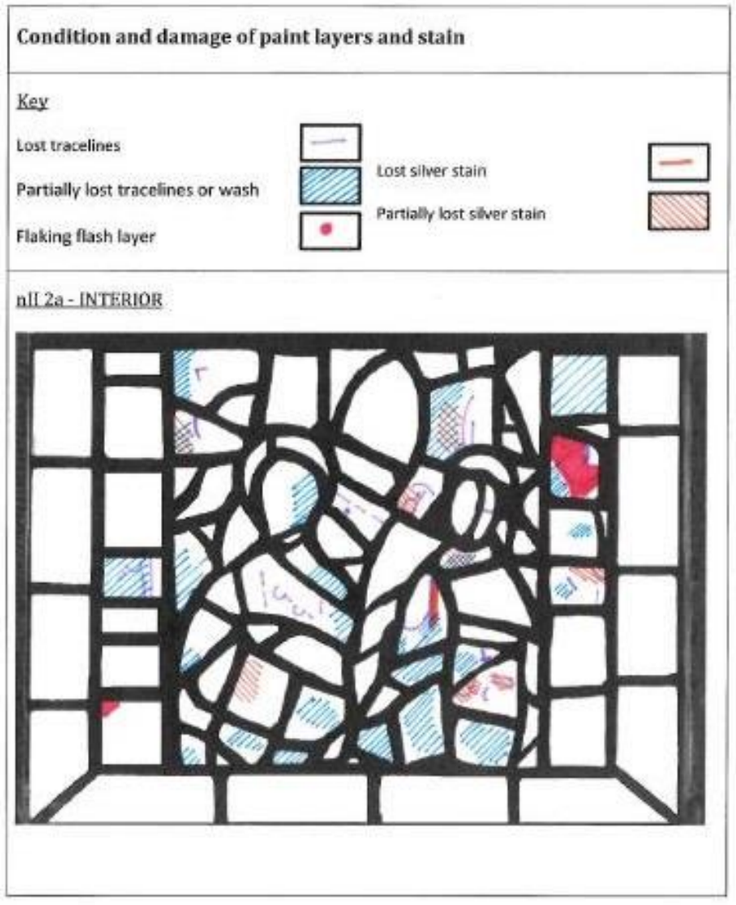
Condition Mapping



Above is a scan of my condition diagram for panel nIII 8b from the church of St. George, Eggstätt, Germany (Derix). It highlights areas of surface dirt and accretions, missing glass, broken leads, pieces inserted in reverse, cracks in lead etc. Although the key is not included in this image, the letters, numbers and symbols refer to various problems – June 2013

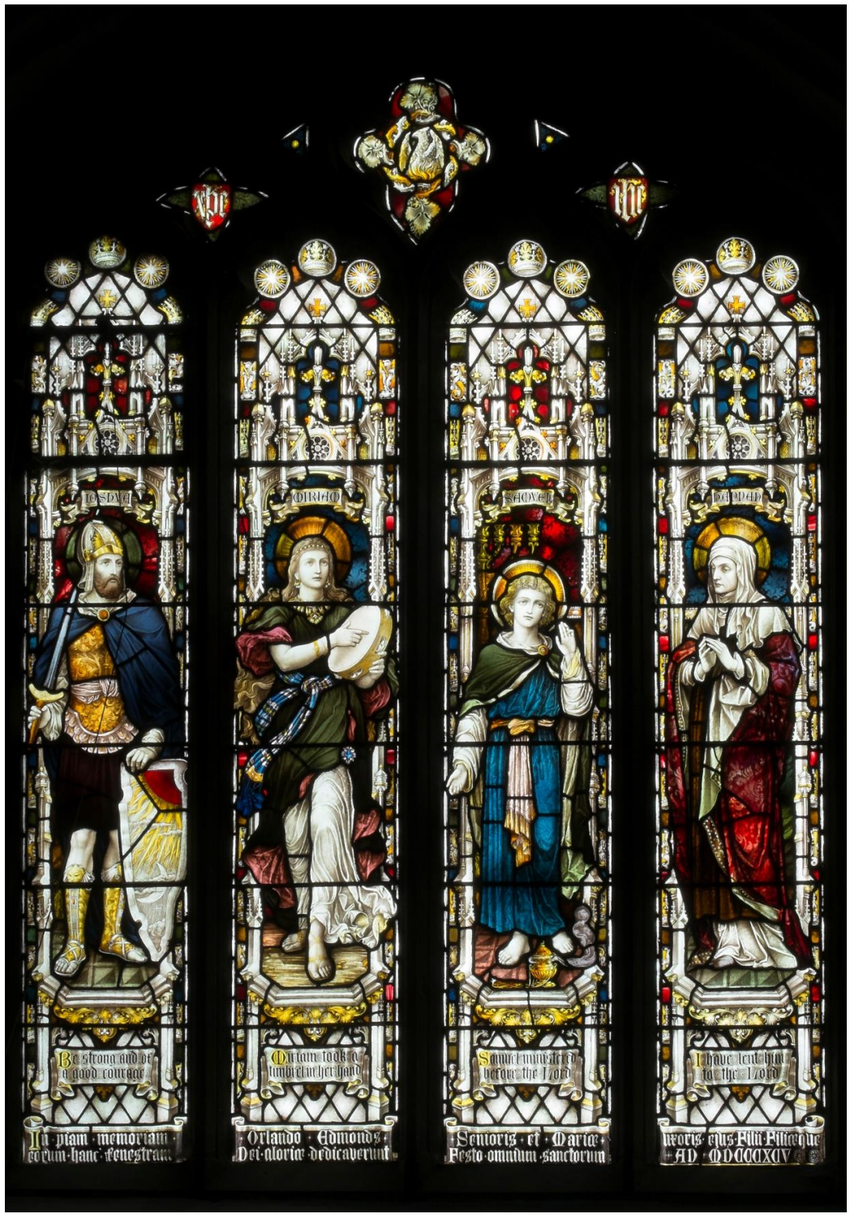


Above is a photograph of my condition diagram for panel Sakr.II 9b from the church of St. George, Eggstätt, Germany (Derix). It highlights areas of dirt and surface accretions, especially thick layers of silicone, broken glass, mould, damaged leads and areas of previous repair i.e. mending leads and strap leads – June 2013.



Above is a scan of my condition diagram for panel nII 2a of Holy Trinity church, Goodramgate, York (MA). Included is the key and it highlights the condition and damage or loss of paint and stain on the glass – August 2014.

Photography

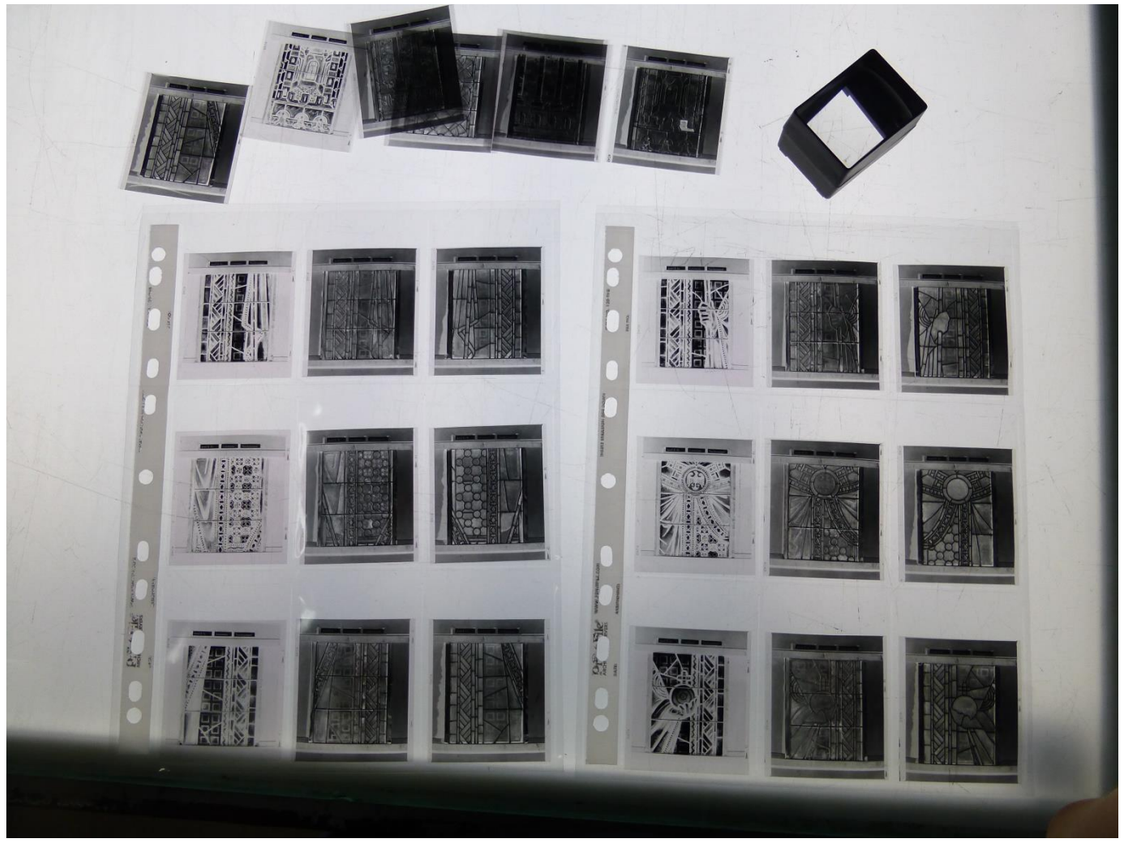


I am able to photograph stained glass *in situ* to a very high resolution and a standard useful in all types of production, including documentation. The photographs above were taken for the church of All Saints, Stamford in Lincolnshire with the view of producing professional postcards and for use in a published book. As is clear from these images I am capable of taking a photograph of a whole window in perspective (image right: taken with Fuji X-Pro1, exposure: f/22, 1/8s, ISO 200, 55mm) and close-ups of specific areas in a window, i.e. the angel from a tracery panel pictured on the left (taken with Fuji X-Pro1; exposure: f/11, 1/125s, ISO 640, 125mm) – August 2015.

I have received training in producing high resolution images for a conservation report, before and after conservation, using a light box. The above image was taken in the photography portakabin at Derix Glasstudios – July 2013.

Above is a panel in the process of documentation photography. It is a complex and fragile shape, setting it up in the frame required precision and care – July 2013.

Above I am labelling, organising and filing a set of photographic slides for the documentation of a project on the church of St. Mary, Bad Segeberg, Germany (Derix). The client required several versions of photographic productions for the project due to the liklihood of such documentation being accidentally lost or damaged over time – August 2013.



Another version of the documentation images for the project at Bad Segeberg, this time black and white negatives, which I filed and labelled into document folders – August 2013.