The Zibby Garnett Travelling Fellowship

Report by Jennifer Brunton

MLitt Technical Art History.
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Figure 1. http://www.lib.utexas.edu/maps/world_cities/cleveland.jpg

Figure 2. http://www.clevelandart.org/sites/default/files/images/homepage-feature/full/BannerBenefit_desktop.jpg

Figure 22. http://www.universitycircle.org/events/2017/06/14/wow-wade-oval-wednesdays
Introduction.

1.1 Overview.

My name is Jennifer Brunton, I am 22 years of age, and currently studying for a postgraduate degree in Technical Art History at the Centre for Textile Conservation and Technical Art History at the University of Glasgow. The course lasts 12 months and culminates with an end of year dissertation project. Technical Art History focusses on ‘the act of making’ through object-based and interdisciplinary research, bridging the gap between conservation science and art history. Technical Art History gives consideration to materials and technique, whilst studying artist intentions and concept, ensures these principles are at the forefront of our own practice. Technical Art History allows conservators and curators to consider artist intent, making and meaning, ensuring the artwork is appropriately conserved, interpreted and accessible for future generations.

Prior to joining the Technical Art History course, I gained an MA (Hons) in History of Art at Glasgow University, graduating in 2016. Therefore, my choice to continue to study at Glasgow University was an easy one to make. My interests lie predominantly with materials, more precisely textiles, alongside a keen interest in conservation studies, specifically looking into the complexities of the conservation and preservation process of objects in keeping with maintaining authenticity and artist intentionality. Particularly how this multifaceted issue is dealt with in the museum environment and conveyed to the public.

The dissertation project I chose to take on was in conjunction with The Cleveland Museum of Art, in Ohio. The project focussed on Caravaggio’s painting *Crucifixion of Saint Andrew*\(^1\) which is in the permanent collection at Cleveland. More specifically, my objective was to create a reconstruction of the paintings’ canvas weave in order to gain further insight into the physical process the artist would have carried out in terms of materials and methodologies used. This reconstruction aimed to gain a greater understanding of the weaving process in relation to how the construction of this weave affects the extent of cusping formed along the edges of the canvas in the picture plane due to its attachment to a stretcher. In the case of this painting it was thought that the painting may have been cut down in size at some point in its history. Thus less cusping would be visible on the cut down sides. However, inferences drawn from the cusping had to date been extrapolated from plain weave canvases, rather than the complex weave of the Cleveland painting.

\(^1\)See Appendix 1 for image.
This unexplored area of research, into complex weave structures will provide a greater understanding of their properties and a fuller understanding of the history of a canvas painting to contribute towards any future conservation treatment.

I had initially heard of the Zibby Garnett Travel Fellowship through my dissertation supervisor Dr Christina Young. Specifically, when I took on this dissertation project which was based at The Cleveland Museum of Art, it became clear that visiting the institution would be a vital part of my research.

1.2 Budget.

The total cost of my study trip amounted to £2110. The Zibby Garnett Travel Fellowship generously awarded me £800 to go towards the total cost of this trip. The rest of my trip was paid using my wage from my part-time job I had kept on throughout my post-graduate year.
Placement Overview.

2.1 Cleveland.

Prior to arriving in Ohio, it was an area of America I was yet to visit, therefore this was an incredibly exciting opportunity not only in terms of my own research but also a chance to explore a new city. Ohio is a Midwestern state in the Great Lakes region of America.

Cleveland is situated on the southern shore of Lake Erie and was founded in 1796, becoming a predominantly manufacturing centre, due to the location of the city. The city has a population of 388,072 people, making it the 51st largest city in the United States.
2.2. The Cleveland Museum of Art

Located in the Wade Park District, in the University Circle neighbourhood on the east side of Cleveland, the Cleveland Museum of Art is recognised internationally as a significant forum for exhibitions, scholarship, performing arts, art education and holds a collection which is respected for its quality and scope. The museum is renowned for its Asian and Egyptian art and houses a diverse collection of 45,000 objects and works of art from all around the world. The museum was founded in 1913 and is one of the most visited art museums in the world.

3.1. Learning Objectives.

In 2014, the museum carried out crucial conservation work on the painting. ‘Conservation in Focus: Caravaggio’s Crucifixion of Saint Andrew’ enabled the necessary conservation work to be carried out in front of museum visitors, a first for the museum, allowing audiences to witness the skill, preparation, research and technical analysis that contribute to such a crucial conservation project. Conservation on the painting did not involve any investigation into the cusping, therefore questions still remained specifically in relation to the canvas and the
cusping found on the edges of the painting.\(^2\) The main interest from the museum’s perspective and conservator of paintings Dean Yoder who had carried out the conservation, was to have a canvas with a similar weave constructed and tested as the Caravaggio painting appeared to have been trimmed both at the top and bottom. However, the question of how much was unclear. An initial estimate was 10 inches on both top and bottom, this was assuming that the canvas stretched equally in both warp and weft directions. Dean Yoder’s expert knowledge and experience lead him to question this, particularly when considering that linen canvases tend to stretch unequally in both warp and weft, this is due to the nature of the yarn and the weaving process. Furthermore, the structure of the weave is complex and involves regular floating warp threads, which again would alter how the canvas reacts once on a stretcher. The weave count, taken from section of the canvas where cusping was not present, was 14 threads per cm.\(^3\)

Giving consideration to this, my main research aims during my week with the museum looked to gaining a greater understanding of cusping. This involved stretching various canvases using different techniques, therefore gaining a greater understanding how cusping works on plain weave loom state linen. Subsequently, attempting to recreate the size and ground layers that Caravaggio would have applied was necessary in order to assess the reaction the linen would have had in terms of shrinkage and locking in the cusping pattern.

In relation to my dissertation my overall aims were to replicate the canvas weave of Crucifixion of Saint Andrew. Using the fabric to assess the mechanical properties of the weave structure, predominantly the stretching quality of the canvas, specifically when attached to a stretcher, this subsequently would provide an answer as to whether the painting was cut down. Assessing Caravaggio’s style and technique informed my own reconstruction, alongside his movements across Italy during his lifetime, in order to understand the origins of the canvas itself. On a broader scale, considering canvas weaves which have a complex structure, this research may provide some understanding of how these structures should be approached from a conservation perspective.

\(^2\) See appendix 2 for images of cusping on the painting.

\(^3\) See appendix 3 for an image of the weave diagram.
4.1. Day One: Stretching the First Canvas.

I arrived in Cleveland on Sunday the 9th July ready and eager to begin my week working with Dean Yoder at the museum. As I was only able to spend a week in Cleveland I got started straight away. Using loom state linen from Libeco, a Belgian linen company, I began to stretch my first canvas. The linen from Libeco was a balanced plain weave. The original canvas is not accessible and has been lined, therefore a comparison between the original canvas and the Libeco linen was not possible. The stretcher I used was rectangular. Making sure the selvage edges ran horizontally, I began to prepare the linen.

When cutting the canvas to fit the stretcher there was an excess of 3 inches left around the stretcher. Prior to stretching the canvas, the elasticity of the linen was noticeably greater in the warp and taut in the weft, this was possibly related to the weaving process as the warp is continuously under tension and relatively straight, whilst the weft moves through the warp. The initial task of stretching the canvas was carried out using tacks, whilst making sure the canvas was stretched evenly by following a single thread along the stretcher bar. Once the canvas was carefully stretched, avoiding cusping, any tension which was displayed could be clearly seen in the warp, with little observed in the weft.
Fig 5. Nailing the fabric to the stretcher. Tool created by Steven Prins painting conservator in private practice in Santa Fe, New Mexico, USA.

Fig 6. Close up of attaching the fabric to the stretcher. Being careful to keep the distance and level of the nails the same as this can affect cusping.

Fig 7. The finished stretched canvas, prior to pre-shrinking.
4.2 Day Two: Part One. Working on a Glue Size Recipe.

My second day in Cleveland focussed on attempting to recreate an appropriate glue size recipe, through analysis of cross-sections taken from the Caravaggio painting and looking to Italian and Spanish treatises to understand the ingredients which would have been used. One of the issues that quickly became clear, despite the resources available, was the unknown quantity of each ingredient.

It is not confirmed whether the original canvas was sized, or what it was sized with, as this was standard practice is it thought to have been sized. For my reconstruction, rabbit skin glue (RSG) size was used. A 5% size in a gelled form was applied to the first canvas, this was made from a 10% solution which was then diluted and left to set in the fridge. Before application of the glue size the canvas was not re-stretched. However, this strength was too viscous to spread with a palette knife and so the glue was placed in a bain-marie until it was liquid and then applied with a brush. The application of the glue size as gel only formed a film over the surface of the canvas rather than penetrate the fibres, applying the glue size as a warm liquid fully saturates the canvas fibres.
Fig 9. 5% rabbit skin glue size in a gelled form.

Fig 10. Dean Yoder applying the gelled glue size.

Fig 11. Placing the gelled glue size in a double boiler and heated it until it was liquid and then applied onto the canvas.

Fig 12. This gel was applied in sections and any excess scraped off so no excess solution sat on top of the canvas.

Fig 13. The extent of the cusping after the glue size was applied, the ruler indicating how far the cusping extended into the canvas. This is on the weft threads.
Once the glue size had been applied as a liquid, the weft showed extensive cusping whilst the warp showed on a small amount of cusping. Although the presence of starch was confirmed, whether it was added by Caravaggio is unknown. Recipes from Spanish and Italian treatises deal with the use of flour as part of ground recipes. Making a wheat paste to add into the ground mixture to see what effect this had on the ground mixture was deemed appropriate. Therefore, 33 grams of wheat paste was mixed with 400 ml of de-ionised water on a low heat until the consistency became glue-like and stringy. This was strained twice.

4.2.1 Day Two: Part Two. Preparing a Glue Ground Layer.

On the first canvas the ground mixture applied consisted of 200 ml of 5% RSG with 150 ml of de-ionised water gradually adding 100 grams of fuller’s earth clay and 20 grams of chalk. Bone black and water were mixed together, and this was combined with 20 grams of wheat paste. This combination was then applied to the canvas with a flexible palette knife producing a grey colour, as the carbon black pigment had not been ground into the mixture black streaks were present over the grey colour.
After drying, fine cracking appeared all over the surface of the canvas. This was in part due to the linen and due to the mixture being too dry. Therefore, it seemed necessary to go back to assessing ways to reduce the level of shrinkage in the linen, whilst also reconsidering the size and ground recipes to eliminate cracking.

4.3 Day Three: The Second Canvas and WOW!

On a second canvas a weaker solution of 3.8% RSG size was added trowelled on with a malleable palette knife. Using various methods to apply the glue size allowed for a greater understanding of the interaction between the size and canvas. Once back in Glasgow, I used a brush to apply two different strengths of glue size to three separate canvases. The gel was applied in sections with any excess solution scraped off. A weaker solution was used due to the cracking seen from the first canvas, by using a weaker glue size it was thought that this would cause less shrinkage in the linen and it could be identified as a possible reason the first canvas had failed.

![Fig 17. Application of a 3.8% rsg glue size solution with a palette knife. The diluted solution in this gelled form soaked into the canvas.](image1)

![Fig 18. The extent of the cusping after the glue size was applied, the ruler indicating how far the cusping extended into the canvas. This is on the weft threads.](image2)
The second attempt at the first ground layer consisted of mixing a small amount of bone black, raw umber and yellow ochre together with 10 grams of fuller’s earth and 5 grams of chalk and water, combined together until it became a Greek yogurt consistency. The ground on the Caravaggio painting is coarse and so it is possible the clay used for the purposes of this reconstruction was too finely ground. In a separate section of the canvas, 50ml of 4% RSG and 4g of honey was then added to 50g of the mixed pigments along with 2/3 drops of walnut oil. However, cracking still occurred once the mixture had dried.

Fig 19. The second attempt at the ground layer. This mixture includes bone black, raw umber and yellow ochre mixed with de-ionised water then 10 grams of fuller’s earth was added with 5 grams of chalk. This was mixed until smooth and repeated.

Fig 20. Pigments that were used with the addition of terra Rosa which was not included.

Fig 21. Quantity of the three pigments used; bone black, yellow ochre and raw umber.
4.3.1 WOW! (Wade Oval Wednesday).

Every week throughout the summer months free concerts are held on Wade Oval, situated at the centre of the University circle. Along with this, museums are open later on a Wednesday. As I had been working in the museum until 5pm every day, I took this opportunity to explore areas in the museum I had not had the chance to visit. Afterwards I walked over to Wade Oval and enjoyed the food trucks and the concert that was on. The week I was in Cleveland the band playing was Mary’s Lane, an Irish Folk Rock group.

Fig 22. Wade Oval Wednesday at the University Circle.

4.4 Day Four: Experimenting with Ground Recipes.

My second last day with the museum involved trialling various combinations of ingredients which were common in both Italian and Spanish treatises and would have been available to Caravaggio. A 2% RSG size was applied to the canvas and a glue ground layer was mixed using the same pigments as the previous day along with 2% RSG size. This was applied onto a section of the canvas, left to dry and then another layer added, then to the ground mixture 2/3 drops of walnut oil were added and applied to the next section of canvas. The third section was one layer of the ground mixture.
4.5 Day Five: Last Day and Boiling the Third Canvas.

My final day at the museum involved boiling and stretching my third and final canvas. A recurrent issue with the linen was the extent to which the fabric would shrink and expand when the canvas was wetted then re-stretched, the size added and then the ground layer added. Therefore, it seemed appropriate to boil the linen for 20 minutes to remove any sizing and preshrink the cloth prior to stretching. After rinsing, the wet linen was stretched. Interestingly, the linen was easy to stretch and once dry was wrinkled and loose. Upon re-stretching the linen was much easier to pull in both warp and weft directions, perhaps due to the size having been taken out during boiling. Cusping was now present, mainly in the weft and still little cusping could be seen on the warp.
On the third canvas a gel solution of 2% RSG was applied using a knife. Our last attempt at ground mixture was recreating Vasari’s recipe, which used 2 cups of flour, 2 tbsp lead white and walnut oil to make a paste. This instantly turned powdery on the canvas and the oil soaked through as the glue size was too weak. As sizing was used to protect the support from decay or rot, this size wouldn’t have been used realistically as it provided no protection for the canvas.

This experiment highlighted that even though there is more stretch initially in the warp threads, it is the weft that produces the greatest level of cusping. In relation to the Caravaggio canvas, which has extensive cusping on the weft and little cusping on the warp, the same effect can be achieved by stretching then shrinking or by preshrinking, stretching whilst wet and then re-stretching. Being able to produce the same pattern of cusping provided further evidence to suggest that the Caravaggio canvas was not cut down.
4.6 Back in Glasgow: Stretching the Huckaback Canvas

Upon returning to Glasgow, stretching both the plain weave and huckaback weave could begin. Initially stretching the plain weave, I began by marking out where the tacks would be nailed, leaving a 4mm gap between each tack. Stretching the plain weave canvas was difficult, as the weave was extremely stretchy, therefore once I had finished, a slightly uneven pull was visible in the fibres. Unexpectedly, stretching the huckaback weave was a much easier task, it appeared much more stable in comparison to the plain weave. I was able to achieve a much more even stretch across the fabric.

Fig 28. Green marks on the right of the stretcher marking where each tack would be placed.

Fig 29. Image of tacks.

Fig 30. Nailing the tacks into place on the plain weave canvas.

Fig 31. Nailing the tacks into place on the huckaback weave canvas.
Fig 32. Image of the plain weave canvas after stretching.

Fig 33. Image of the huckaback weave canvas after stretching.
Weaving both a plain weave alongside the huckaback allowed for a control canvas. This proved to be invaluable, particularly when stretching the canvas, as the elasticity which was present in the plain was not as prominent in the huckaback. It is possible the structure of the huckaback weave is the reason for this. The cusping on the plain weave canvas extended 5mm in towards the centre of the canvas. In comparison, the cusping in the huckaback canvas extended 9mm inwards on the weft. In the warp little cusping was produced, confirming that linen fabric does not stretch equally, and cusping in the huckaback weave is greater in the weft than the warp yarn.

Fig 34. Image highlighting the cusping on the weft of the plain weave canvas.

Fig 35. Image highlighting the cusping on the weft of the huckaback weave canvas.
Conclusion

My week at the museum was incredibly rewarding. Although faced with numerous challenges, both Dean and I were able to gain a greater understanding of linen canvases and work through numerous different size and ground recipes. The untreated loom state linen from Libeco that was used for all three canvases, was found to stretch more in the warp direction, and about 50% more in the weft. Therefore, the fabric shows greater resistance when pulled horizontally or along the weft. Once the canvases had been evenly stretched, careful to avoid cusping through over-pulling the linen and water had been applied over the canvas, the fabric shrinks quite dramatically, producing cusping in the weft direction with little cusping found in the warp direction. From stretching the canvases in Glasgow, it was clear the same cusping, extensive in the weft in comparison to the warp, is produced just by stretching the fabric. It is possible this occurred due to this fabric being made on a single loom rather than industrially produced mechanically. The huckaback structure intensifies the cusping on the weft, due to the floating warp weaves.

The attempts made at applying a water-based ground using clay and pigments with other trial ingredients such as flour, starch paste, honey and walnut oil, despite our best efforts, did not work. Cracking was found in all the canvases we applied a ground mixture to, appearing between the linen fibres. The mixtures were possibly too dry, alongside the shrinkage in the linen would not allow the ground to dry without cracking, despite adding plasticizers like honey.

In relation to my overall dissertation aims, the knowledge attained from trialling recipes alongside using knowledge from the cross-sections of the original canvas informed the reconstruction, subsequently learning about the effect different quantities and variations these mixtures had on the canvas. I was also able to learn a great deal about how linen reacts once stretched onto a strainer or stretcher and through trialling the different techniques to stretch the canvas we were able to recreate a similar cusping pattern to that on the Caravaggio canvas. This finding provided a greater understanding of how linen with this type of weave stretches. Subsequently giving a greater grounding to argue that it is probable the original painting was not cut down, based on the lack of cusping along the top and bottom. This practical research has given me invaluable experience into a very important element of technical art history and conservation, namely understanding both intellectually and practically how materials behave in relation to the making and meaning of paintings.
Acknowledgements

Thanks to my supervisor, Dr Christina Young for giving me continued support and guidance throughout my research.

To Dean, thanks for all the guidance and support given to me throughout my dissertation project. To the conservation department at The Cleveland Museum of Art, thank you for welcoming me into your workplace.

I would like to thank The Zibby Garnett Travel Fellowship, for providing me with the opportunity to travel to The Cleveland Museum of Art. This trip has provided the chance to continue a conversation on an issue which has not been studied at length. The research conducted both at Cleveland and at Glasgow University has provided interesting and significant results and importantly has provided a reference for further research.
Appendix 1.

The Crucifixion of Saint Andrew (1606-1607)
Artist: Caravaggio (Italian, 1571-1610)
Medium: Oil on textured canvas
Framed: 233.5 x 184 x 12 cm (91 7/8 x 72 7/16 x 4 11/16 in)
Unframed: 202.5 x 152.7 cm (79 11/16 x 60 1/16 in)
Location: The Cleveland Museum of Art
Credit Line: Leonard C. Hanna, Jr. Fund 1976
Collection in museum: European Painting and Sculpture

Image courtesy of The Cleveland Museum of Art.

More information can be found on the conservation of Caravaggio’s Crucifixion of Saint Andrew:

Appendix 2

X-Ray of left side of canvas. Image courtesy of The Cleveland Museum of Art.

_Conserving Caravaggio’s Crucifixion of Saint Andrew: A Technical Study._
X-Ray detail highlighting the extent of the cusping on the weft. Image courtesy of The Cleveland Museum of Art.

*Conserving Caravaggio’s Crucifixion of Saint Andrew: A Technical Study.*

Appendix 3


*Conserving Caravaggio’s Crucifixion of Saint Andrew: A Technical Study.*