Concrete Thinking: How a Study of American and British Remounting Methods Informed the Treatment of Two Delft Tile Fireplaces at Winterthur Museum

ABSTRACT

A 2016-2018 postgraduate fellowship project at Winterthur Museum, Garden & Library aimed to research the collection's 515 Dutch and English delft tiles, many of which were mounted in fireplace surrounds throughout the house during Henry Francis du Pont's 1930s expansion of his family home into a historic house museum. A survey revealed that two fireplace surrounds were in worse condition than others in the house, igniting a discussion regarding whether or not to de-install the tiles and remount them with conservation-grade materials. A study of American and British tile remounting techniques gleaned from a literature review and interviews with conservators led to the decision to treat the two tile fireplace surrounds in a minimally interventive way.

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DELFTWARE TILES AT WINTERTHUR

Winterthur Museum, Garden & Library boasts a vast collection of decorative art objects displayed throughout a 175-room house and in permanent and changing exhibition galleries. Winterthur's collection contains 515 tin-glazed earthenware delft tiles of Dutch and English origin. The majority of these, 314 tiles are mounted in 12 fireplaces throughout the house. The collection also contains 186 unmounted tiles, as well as a small table with 15 tiles set into the top.

In 2016, Winterthur established a postgraduate fellowship to study and treat the museum's collection of tiles, both mounted and unmounted. The goals of the project were two-fold. First, to conduct a condition survey of the collection to prioritize treatments; 51 tiles were conserved based on the results of the survey. Second, to conduct in-depth research into the history of delft tiles, including original use, decontextualization by dismantling, and subsequent purchase by collectors like Henry Francis du Pont. This research included collating the purchase records of all tiles in the Winterthur collection.

The condition survey led to the development of a third project goal: to address the poor condition of two fireplace surrounds. A flood in the 1980s damaged the Vauxhall Room fireplace, causing loss to the tiles and plaster surround due to the migration of soluble salts. Discovered during the initial condition survey, the top row of tiles in the Bertrand Room fireplace surround moved freely when pressure was applied. Extensive research was conducted into both historic and

modern approaches to mounting tiles in the United States and the United Kingdom to determine if the surrounds should be dismantled, treated, and then remounted with conservation-grade materials. Museum professionals throughout the United States and the United Kingdom working in collections with mounted tiles were consulted to find a best-practice mounting method and to inform treatment decisions for the Vauxhall and Bertrand fireplaces.

Delft tiles in America

Archaeologists commonly find Dutch and English delft tiles in colonial American sites, indicating their immense popularity with the middle-class colonial population (Cotter et al. 1995; Cantwell and Wall 2001; Luckenback 2006; Stiner 2010; Poole 2014). However, according to archaeologist Al Luckenback (2006), American buildings with in-situ fireplace tile treatments are surprisingly rare. In her comprehensive thesis about delft tiles in Charleston, South Carolina, Josslyn Kay Stiner (2010, 55) recorded only 98 original delft tile fireplaces in the United States. In private homes, marble slabs often replaced delft fireplace surrounds beginning in the 1820s, helping explain their scarcity (Kauffman 1972, 86; Luckenback 2006). Additionally, in the early 1800s, the use of cast-iron stoves overtook less-efficient open fireplaces for cooking and heating homes (Korf 1964, 25).

Tiles did not fall out of fashion forever, enjoying a brief revival around the turn of the 20th century due to the popularity of William Morris' designs (Jackfield Conservation Studio). As historic buildings were demolished, many tiles were removed from their original contexts as part of the 20th-century phenomenon of collecting architectural elements (Peck et al. 1996; Harris 2007; Bryant 2009). Tiles, previously serving both utilitarian and decorative functions within middle-class homes, became collectables. Dealers and auction houses sold sets of similarly-decorated tiles as mounted panels or as unmounted groupings, even if the tiles did not originate from the same location. Prolific collectors like du Pont amassed and installed these tiles to evoke a romanticized vision of bygone eras in their homes, as presented in the historic interiors at Winterthur Museum (Peck et al. 1996; Harris 2007; Bryant 2009).

HISTORIC MOUNTING AND REMOUNTING MATERIALS AND METHODS

From the use of traditional materials such as lime plaster, to inventive materials like foaming polyurethane resin, the materials used throughout the history of mounting tiles are surprisingly diverse. Remnants of every type of mounting material imaginable can be found on the backs of tiles. Winterthur's tiles alone display residues of lime plaster, gypsum plaster, Portland cement, epoxy resin, Duco cement cellulose nitrate adhesive, and sticker mounting tabs, identified visually and with microchemical spot tests (Odegaard, Carroll, and Zimmt 2007, 124-125).

Inappropriate mounting materials can spell disaster for tiles and the conservators who work with them. Mounting materials were often applied without a barrier layer to the unglazed earthenware versos of tiles. Panels or backing boards made of wood easily warp in response to changing relative humidity, causing tiles to crack and break. Removal of tiles using solvents and mechanical methods can pose health and safety concerns to conservators and others working in museum collections. In an extreme example, Asbestolux asbestos insulation board was used in the UK from the 1950s until the early 1980s as a rigid support for tiles (Meller and Ling 2009, 104), and its removal should only be undertaken with extreme health and safety precautions by a licensed abatement professional.

Historical mounting systems found in homes, private collections, and museums can be divided into two broad categories: 1) plasters and cements, and 2) adhesives.

Plasters and cements

Lime plaster and lime mortar constitute some of the earliest tile mounting materials. Tiles in their original contexts are most likely attached to fireplaces or walls with lime plaster, which has been used in Europe for centuries (Henry et al. 2015, 836). Lime plaster is one of the most compatible mounting materials for delft tiles. Softer than earthenware, it is likely to fracture or fail first before damaging the tiles and acts as a sacrificial material to protect the porous earthenware from salt damage (Henry et al. 2015, 486).

MOUNTING MATERIAL	IMAGE	PROS	CONS
Lime plaster Verso of delft tile. ca. 1630-1650 CE, glazed ceramic, H 12.6 cm × W 12.5 cm × D 2.2 cm. Winterthur Museum, 1969.4732.012 · Courtesy of James Schneck		Compatible with tin-glazed earthenware Soft, breaks before tiles	Often fails and needs to be repaired May contain sulfates Too heavy to use in panels
Gypsum plaster Delft tile after removal from the Vauxhall Fireplace. ca. 1640-1675 CE, glazed ceramic, H 10.8 cm × W 12.7 cm × D 1.8 cm. Winterthur Museum, 1969.4722.002		Relatively strong Less affected by water than lime plaster	Contains sulfates Harder than lime plaster Too heavy to use in panels
Portland cement Tiles in the Bertrand Fireplace. ca. 1760-1775 CE, glazed ceramic, H 12.4 cm × W 12.7 cm. Winterthur Museum, 1969.4720.004 (below) and H 12.4 cm × W 12.4 cm. Winterthur Museum, 1969.4720.005 (above)		Strong	Too hard Extremely difficult to remove from tiles Can cause salt migration

Table 1. *Mounting materials found on Winterthur's tiles · Courtesy of Winterthur Museum, Garden & Library*

Plaster of Paris, or gypsum plaster, takes its name from the Montmartre gypsum mines. When set, plaster of Paris forms bassanite ($CaSO_4 \cdot 0.5H_2O$), a selenitic or gypsum-containing mortar, which is usually much harder than lime plaster (Henry et al. 2015, 886). Throughout history, it has been used to create elaborate ceiling motifs, as a casting material, and for medical bandages. Victorian collectors used it to attach tiles to wood or slate backings, creating impossibly heavy panels (Blackshaw and Cheetham 1982, 71). It was also used to remount newly purchased antique tiles in fireplaces through the 1930s, as in the case of the Vauxhall fireplace at Winterthur Museum (Table 1).

Portland cement became the most commonly used building material after the 1860s (Henry et al. 2015, 836). It is much stronger than the ceramic, causing tiles set in it to crack and rendering it almost impossible to remove from tiles without damage (Durbin, personal communication, 15 February 2017; Henry et al. 2015, 844). In the 1930s, masons assembled the fireplace in the Bertrand room using Portland cement (Table 1). This was identified visually and in consultation with Winterthur masons (Terranova, personal communication, 07 January 2017). In the same time period, the Colonial Williamsburg Foundation also reconstructed a delft tile fireplace in the Governor's Palace using Portland cement, based on fragments of tiles found during excavations in the 1930s (Poole 2014; Silence and Williams, personal communication, 30 June 2017).

Adhesives

Collectors, dealers, and ceramics "repairers" used early adhesives such as waxes, natural resins, wax/resin mixtures, and proteinaceous glues like animal skin glue and fish glue to remount loose tiles into panels for easy display. Later synthetic adhesives such as cellulose nitrate, stronger adhesives such as foaming epoxy resins (Buys and Oakley 1996; Jordan 1999), polyester resins (Buys and Oakley 1996), commercial rubber adhesives (Mellor and Ling 2009), and acrylics such as

MOUNTING MATERIAL	IMAGE	PROS	CONS
Animal glue Historic wooden frame in the PMA's teaching collection with small pieces of tile stuck to animal glue		Reversible with warm water	Shrinks, embrittles, yellows with age Stronger than necessary
Duco cement cellulose nitrate Tile in the Patuxent fireplace. ca. 1760 CE, glazed ceramic, H 12.7 cm × W 12.7 cm. Winterthur Museum, 1969.4729.025 · Courtesy of Winterthur Museum		Relatively strong Readily reversible	Yellows with age
Polyurethane resin The back of an English late Medieval floor tile. ca. 13th-14th century CE, H 14.7 cm × W 15.3 cm. The British Museum, 1947,0505.1342 · Courtesy of The British Museum		Strong	Heavy Extremely difficult to remove from tiles
Foaming epoxy and polyurethane resins Foaming polyurethane resin on the back of an English late Medieval floor tile. ca. 13th century CE, H 14.4 cm × W 14.4 cm. The British Museum, 1947,0505.921 · Courtesy of The British Museum		Lighter than plaster and polyurethane resin	Weak, requires additional armature Hard to control rate of foaming Softened only with hazardous solvents Extremely difficult to remove from tiles Respiratory hazard of foam dust

Table 2. *Tile adhesives found at the PMA, Winterthur, and the British Museum*

PARALOID B-72 (Payton 1999) were also used to attach tiles to wooden frames, thin wooden flats of cigar boxes, or slabs of slate for display in private homes and museums (van Dam and Schaap 1984, 188). While removing tiles from Victorian frames at the Philadelphia Museum of Art (PMA), conservators encountered a combination of wires and animal glue, which had pulled pieces of earthenware from the tiles as the wood warped. All told, over a third of the tiles in the PMA were damaged by their previous mounts (van Dam and Schaap 1984, 188).

Historic restorers first used cellulose nitrate, one of the first synthetic plastics, as an adhesive in the early 1920s (Selwitz 1988). Conservators used cellulose nitrate to adhere tiles to panels throughout the 20th century (Jordan, personal communication, 12 September 2017), sometimes mixing it with sand to create a filler material or grout (Shorer 1971, 2000) (Table 2).

The Ceramics, Glass, and Metals Conservation Department at the British Museum engaged in a project to remove portions of their vast collection

of medieval floor tiles from extremely heavy historic mounts (Ling, Camurcuoglu, and Orsini, personal communication, 13 September 2017). While attempting to dismantle one of the panels, conservator Miriam Orsini found that thick globs of insoluble polyurethane resin, cardboard, and plaster were applied to the reverse of the tiles without a barrier layer (Table 2). After exhaustive testing, Orsini concluded that the work to remove the resin from the backs of the tiles was not worth the risk of potential damage.

In an attempt to reduce the weight of often extremely heavy tile display panels, conservators in the 1970s and 1980s at the British Museum and the Victoria and Albert Museum (V&A) experimented with foaming resins. Conservators at the V&A used foaming epoxy resin (Larney 1971; Blackshaw and Cheetham 1982; Buys and Oakley 1996; Jordan 1999), while conservators at the British Museum utilized expanded polyurethane foam (Bargazova, personal communication, March 2016) (Table 2), neither of which is easily reversible. While these systems contributed less weight from adhesives and plasters, the fragile nature of the foam necessitated extra support in the form of metal mesh and aluminum struts.

Museums and private collections have remounted their newly-acquired tiles in a multitude of creative ways. Display panels apparently consisted of anything at hand, from slate to particle board. Any adhesive that stuck was utilized, including animal glue, Portland cement, and gypsum plaster, without regard for potential interactions with the often-fragile tin-glazed earthenware. Even today, there is no consensus amongst conservators as to when it is necessary to remove tiles from their original or historic context, whether or not to remount them, and which materials and methods to use in the process.

MODERN METHODS OF TILE REMOUNTING

A major part of remounting research concerned whether Winterthur's fireplaces were museum displays or architectural features in a historic house. Would it be more appropriate to set them in lime plaster, as they would traditionally have been mounted? Or would it be best to implement the museum standard of aluminum panels?

Tiles in historic homes: Lime plaster

Conservator Michaela Neiro (personal communication, November 2016), Historic New England, advised using lime plaster to remount tiles in order to preserve their historic integrity and because of lime plaster's compatibility with earthenware. This is a common practice in historic building and architecture preservation, but much less common in contemporary objects conservation practice. The comprehensive architectural conservation manual, *Historic England Practical Building Conservation: Earth, Brick & Terracotta Vol. 2,* promulgates resetting tiles with a non-hydraulic lime mortar (Henry et al. 2015).

Tiles in museums: Aluminum panel

In the 1980s, conservators at the PMA, which has the second largest collection of delft tiles in the world, embarked on a project to reduce the weight of tile panels using reversible methods and materials (Lins, Meighan, and Stayman 1988; Meighan, personal communication, 7 February 2017). Many museums, including the V&A (Jordan 1999; Jordan, personal communication, 12 September 2017) and the British Museum (Payton 1999; van Schinkel, Brokerhof, and de Groot 2002; Paine 2005; Oliviera 2016), have similarly adapted the system first published by P.B.M. Bolwerk (1982), former director of the Nederlands Tegelmuseum (Noot 1996).

Conservators Andrew Lins, Melissa Meighan, and Wendy Stayman presented their mounting system at the annual meeting of the American Institute of Conservation in New Orleans in 1988. Their solution came out of a tile remounting campaign at the PMA, detailed in Jan Daniël van Dam and Ella B. Schaap's book, *Dutch Tiles at the Philadelphia Museum of Art* (1984). They chose a commercial silicone adhesive, Phillybond TA-30 Tile Adhesive, for its strength, working properties, and shock-absorption and Hexlite aluminum honeycomb paneling for its lightness and non-warping properties.

At the beginning of the PMA remounting process, curators arranged tiles with similar designs into sets for mounting in panels. Next, a barrier layer of PARALOID B-72 was applied in square sections to four corners on the verso of each tile, over which the silicone adhesive was applied. The viscosity

Figure 1. *Conservator Melissa Meighan displaying a didactic of how the tile panels are constructed (left), and Curator Emeritus Mary Anne Dutt Justice showing the verso of a panel with plexiglass windows to allow viewers to see inscriptions on the tiles' versos (right). Tile panel featuring a dolphin, ca. 1600-1625 CE, H 14.3 cm × W 27.9 cm. Philadelphia Museum of Art, 1983-101-169a and 1983-101-169b · Courtesy of Philadelphia Museum of Art*

of the silicone adhesive allowed for leveling of the tiles, which are often of different thicknesses. If any inscription was visible on the reverse of the tiles, a plexiglass window was placed into a void in the Hexlite board. Meighan has had to dismantle a panel and stated that the mounting system is readily reversed by applying acetone to the PARALOID B-72 barrier layer (personal communication, 7 February 2017) (Figure 1).

The V&A embarked on a similar remounting campaign in the late 1990s and early 2000s. Led by Fiona Jordan, conservators decided to attach tiles to Aerolam aluminum honeycomb panels using a conservation-grade epoxy resin, Araldite 2015, as an adhesive, again over a barrier layer of PARALOID B-72 (Jordan 1999; Jordan, personal communication, 12 September 2017). The panels were then placed within wooden frames.

Clips

Many museums display single or groups of tiles individually mounted within exhibit cases, rather than as preassembled panels. The Ashmolean in Oxford devised board-less mounting systems for their tiles, utilizing acrylic clips to secure the objects to a backboard. Another case at the Ashmolean displays medieval floor tiles set into Plastazote (polyethylene) foam cavities, again avoiding adhesives.

CASE STUDY: A TALE OF TWO FIREPLACES

Research into tile mounting materials and methods, past and present, alongside interviews with conservators who have worked with tiles informed the treatment of the tile fireplace surrounds in the Bertrand and Vauxhall Rooms at Winterthur Museum. In 2015, preventive conservators Emily Brown and Matt Mickletz conducted a survey of Winterthur's fireplaces. Those in the Vauxhall and Bertrand rooms were categorized as "Priority 1," or in urgent need of conservation due to structural instabilities. The 2016 tile survey corroborated this assessment.

Vauxhall fireplace: To de-install or not to de-install

In 1938, 32 single, upright Dutch tulip tiles, ca. 1640-1675, were installed in the Vauxhall Room under the direction of du Pont. Du Pont purchased 35 delft tiles with a single upright tulip from New York antique dealer Edwin Jackson on March 17, 1937. These tiles are likely the ones in the Vauxhall fireplace.

Vauxhall's tiles and plaster surrounds sustained heavy water damage from a flood in the summer of 1987. Soluble sulfate salts were confirmed through microchemical spot testing of small samples of white accretions on the tiles' surfaces (Odegaard, Carroll, and Zimmt 2007, 124-125). This makes sense, as the tiles are set directly into gypsum plaster; the lower part of the plaster surround was also delaminating due to the previous water damage (Figure 2).

Figure 2. *Vauxhall Fireplace (left) and detail of salt damage on the tiles and plaster surrounds (right), Winterthur Museum, 1969.4722.002 - 1969.4722.036 (clockwise from the lower proper right) · Courtesy of Winterthur Museum, Garden & Library*

Relative humidity and temperature were monitored by placing an environmental data logger in the fireplace for one year from November 2016 to 2017. The data revealed that the environmental conditions in Vauxhall are stable, suggesting that the damages seen today result from the 1987 flood, not from continued relative humidity cycling. Climate control was installed throughout Winterthur in the early 1960s to protect the objects in the collection on the advice of Harold Plenderleith (Wickens, personal communication, 14 July 2019).

In December 2016, conservators removed two tiles from the lower left side of the Vauxhall fireplace surround with a hammer and chisel to understand how the tiles were mounted, assess the condition of the tiles and the plaster, and evaluate the feasibility of deinstallation. The exploratory excavation revealed that the tiles were set directly into an approximately 1 cm layer of gypsum plaster over a brick substrate. It took two conservators nearly five hours of work just to remove two tiles. It took a further ten hours of working under the microscope with a Dremel handheld engraver tool to remove the tenacious remnants of plaster from the versos of the tiles, then softening the remaining residues with an aqueous solution of 0.5 percent nitrilotriacetic acid (NTA), adjusted to pH 6 with sodium citrate, and gelled with xanthan (polysaccharide) gum.

At this point, there was a decision to make (Table 3). Ultimately, because the environmental conditions in the Vauxhall Room are stable, the plaster surrounds, though damaged, are in relatively good condition, and the potential of damaging the tiles during removal was too great, it was decided not to de-install the remaining tiles. The previously-removed tiles were desalinated. Following desalination, a barrier layer of 20 percent PARALOID B-72 in acetone was applied to the reverse of the tiles, and they were reattached to the resurfaced plaster substrate with 40 percent 3:1 PARALOID B-72:PARALOID B-48N (w/v) in acetone, a mixture that has proven both strong and reversible (Riccardelli et al. 2014, 68). If need be, the two tiles can be easily removed with acetone.

Bertrand fireplace: Much ado a-grout nothing

The 25 London delft Chinoiserie tiles, ca. 1760-1775, in the Bertrand Room fireplace were installed between 1929 and 1930. Winterthur mason Benjamin Terranova (personal communication, 07 January 2017) posited that builders constructed a steel frame to create the fireplace façade and attached tiles with Portland cement on the side columns. The top row of tiles were installed differently, set in gypsum plaster. Both the plaster and the imbedded tiles cracked, possibly because the rigid cement side columns

DE-INSTALL	NOT DE-INSTALL
Nothing is known about the provenance of the tiles before they entered Winterthur Museum	While the tiles are not original to the house, they interpret a historical style and represent a part of du Pont's vision for the Vauxhall Room
The structural integrity of the plaster was potentially compromised in 1987, and salt damage is evident on the tiles' surfaces	The environment in Vauxhall fireplace is relatively stable throughout the year, so the tiles are unlikely to deteriorate further in their current location without another significant water event
Removing the tiles would enable a more thorough conservation treatment and provide the opportunity to implement a more stable and reversible remounting solution than the current plaster system, which has the potential to cause further damage	Tiles could be damaged during the removal process, which would necessitate the use of a hammer and chisel or power tools

Table 3. *This dilemma was presented by the author in a poster at the Icon Ceramics & Glass Group Conference in 2017*

and steel armature did not move with the building as it settled. Though the tiles were still attached to the plaster, the entire row was at risk of falling out, swinging freely away from the steel substrate with gentle pressure (Figure 3). In addition to the structural instability, previous aesthetic loss compensation and overpainting had aged poorly.

While the risk of removing the tiles set in Portland cement prevented complete deinstallation, conservators contemplated whether to remount the top row of tiles on an aluminum panel. However, the difficult experience of removing the two tiles from the Vauxhall fireplace swayed the decision to re-adhere the plaster to the steel substrate, rather than attempting deinstallation. To stabilize the plaster and tiles, 30 percent 3:1 PARALOID B-72:PARALOID B-48N (w/v) in acetone was injected behind the plaster, and the whole row was clamped in place and allowed to set. Historic overpaint and overfill were reduced with a combination of solvents and mechanical action. Large areas of loss on the tiles were filled and inpainted; the work was highlighted as part of a daily public tour of Winterthur's collection and provided a unique opportunity to talk to visitors about conservation and the Winterthur tile conservation project.

CONCLUSION

Research into the history of delft tiles, their influence, collecting practices, and re-mounting techniques, has reinforced the importance of choosing systems that are as reversible as possible. It has also demonstrated how every case, down to the tile, presents its own unique situation where no single right answer can be applied.

Had the decision been made to completely deinstall the Bertrand and Vauxhall fireplaces, the tiles would have been remounted most likely on aluminum panels with epoxy resin or silicone tile adhesive over an isolating layer of PARALOID B-72. However, lime plaster could also have been a viable choice for the Vauxhall's tiles, more in keeping with the du Pont era of mounting and more sympathetic than plaster of Paris. In the end, the path chosen for the two fireplaces was more preventive than interventive: reattach the panel on the Bertrand fireplace, replace the two tiles removed from the Vauxhall fireplace, and monitor both.

Why did so much research effort go into two conservation decisions? There is no consensus, even among conservators who have worked with tiles, as to what is the best remounting system. The best solution for each individual problem and object should be carefully considered. The ethical

Figure 3. *Bertrand Fireplace (left) and detail of plaster and steel armature (right), Winterthur Museum, 1969.4720.002 - 1969.4720.026 (clockwise from lower proper right) · Courtesy of Winterthur Museum, Garden & Library*

and practical implications of each conservation decision must be adequately weighed before pursuing a course of treatment, or, as in the case of the Vauxhall fireplace, determining that no further treatment is the best option.

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