Material imitation and imitation materials in furniture and conservation

Stichting Ebenist
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• Imitation bamboo furniture by William Chambers (Warnow, p. 165)
• Textile imitation lacquerwork from a sedan chair (Huber, p. 116)
• Imitation bamboo chair (Warnow, p. 168)
• Advertising of Deutsche Linoleum-Werke (Kun, p. 150)

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Since the beginning of time, man has attempted to mimic nature, in his efforts to understand and capture the world that surrounds him. Through pictures and artefacts we can witness his desire to adorn everyday objects with natural or man-made symbols. This can lead to interesting results. For example, in the ancient Japanese art of jōmon pottery, we find earthenware dressed up as a braided basket. That seems like an odd choice, since a basket is as watertight as a colander, and the exact opposite of the fired clay.

Why do we use (the concept of) one material to imitate or ‘fake’ another? Sometimes, a trusted material has its shortcomings in size or colour, or it isn’t up to the job in other ways. It seems perfectly sensible to have vinyl furnishing when you are running a busy hamburger restaurant, but there is really no sane argument for the same unpleasant plasticky fabric when upholstering a sofa in which you are going to spend hours of comfortable reading. Every material has its place, so to say. Still, the vinyl fabric might look like leather, because we have been taught that the latter is the material of choice for quality upholstery; and a strong resemblance to it contributes to our appreciation of the imitation product. The same goes for laminate flooring that, most of the time, only remotely resembles a wood floor – but it is sold at a shamelessly low price, hence its success.

Other than a lack of financial resources, the unavailability of a certain raw material is an obvious reason for producing or buying an imitation product. For example, if your local village lumberyard doesn’t trade the exotic wood species that you want to use for decorating a cabinet or wall panelling, you will have to find alternative ways. Italian marble in Denmark? There is nothing that some paint and a brush can’t accomplish.

It would be wrong to regard imitation materials or products as a surrogate. They are not like chicory coffee. Is real tortoiseshell or ivory better than its plastic counterpart? No, those materials are simply a class of their own, and they often reflect a determined place, period or social context.

This selection of papers on material imitation and imitation materials touches upon some of the topics mentioned above. Furthermore, it investigates subjects like high culture versus low culture through imitation, computer technology as a tool in conservation, the analysis of imitation techniques and materials, and many more. Contributions to the 13th International Symposium on Wood and Furniture Conservation have come from young students and experienced conservators alike, who have been working on a wide range of objects, dating from the early Baroque to the mid-twentieth century. The variety of papers sheds an interesting light on the history of our use of materials and their lookalikes.

Special thanks go to Alice Watson and Claire Molgat Laurin at University of Amsterdam, and Simon Brown at Letterfrack Conservation for their indispensable help with the non-native English articles.

Miko Vasques Dias
Identifying and repainting historical graining techniques in interiors dated before 1800

Bernice Crijns

Introduction
Restoring historic interiors often includes reconstruction of the paintwork. Historical painted faux finishes can be part of these reconstructions. Although these imitations are fun to encounter in an interior, comprehending them isn’t an easy task. They are both difficult to date and to identify. Herein we review what information is prerequisite to redecorate an historical faux finish. Knowledge of historical recipes, materials and techniques are – of course - of great importance. For a better understanding of historical faux finishes a project has been started using case studies of painted imitations as references to get a bigger picture of their development through the ages. This article sets out the first results of my work in progress and focuses on the art of graining in the middle of the eighteenth century.

Faux painting
Painted imitations have a long history. There are even examples known dating from Egyptian times. They are made with various kinds of paint, used to decorate interiors and furniture, painted on a whole range of substrates (varying from stucco, wood, textile, metal to paper) and imitate natural materials; mostly expensive wood, marble or even faux Boulle. All practices depend on fashion, the availability of the natural material and of the painting materials used. Faux painting is a decorative technique practiced in every period of time. The figuring can be a realistic copy of the natural material or it can be depicted in a decorative, picturesque or naïve manner.

Graining techniques and materials
We focus mainly on the imitation of wood, also known as graining, painted on architectural elements. As a start the basic principles of graining will be explained here. There are two main techniques used to manipulate paint to look like wood. The imitation is made either by adding paint layers or removing them. A tangentially sawn pinewood, for example, can be built-up painting the heartwood and sapwood on a dry coloured ground layer (figures 1a-d). The second technique works differently. A transparent paint – called a glaze or wash is applied on a dry coloured ground layer (figures 2a-b). This glaze or wash is partly removed to create the wood pattern. Both techniques can also be combined (figures 2c-d) by partially removing or adding paint; in this case a crotch mahogany is imitated. Painters have experimented throughout time with techniques and materials. Everything is allowed - as long as it does the trick. More tools are used besides brushes. When identifying an imitation it is hard to specify the exact natural material that was counterfeited and which materials and tools were used. But if they can be identified, they can be quite surprising. For instance, a technique which in Dutch is generally called ‘blotevoetenmarmer’ and which could be translated into ‘barefoot marble’ (figures 3). The figuring is made using bare feet making footprints in a wet glaze. It is used to decorate floors and is therefore also called ‘(kinder) voetjesvloer’ which means ‘(children’s) feet floor’. The name is as funny as the feet technique looks, because the result in brown paint looks more like a faux wood instead of marble.

Restoring faux finishes in historic interiors

Two restorations will illustrate the objectives to recreate a decorative scheme. Usually in situ research examines the different decorative finishes during time, on all parts of the interior. Historical decorations throughout time are revealed using paint analysis of paint cross-sections and making stratigraphic uncovering sections of the subsequent built-up paint layers. Due to lack of money and time it is not uncommon that the conclusions of the research of the historical finishes are incomplete. Consequently, redecoration is done with quite some assumptions of what the original decoration could have looked like. This paper looks into requirements necessary to recreate one specific type of decoration, i.e. painted faux materials.

In the country house Trompenburg in the town ‘s-Graveland, a curious historical wood imitation was discovered on a door. The door was discovered behind a false wall (figures 4a-d). The large round figuring is thought to date to the 1670s, the date this house was built. This imitation is usually referred to as a naively painted walnut burl but it could very well counterfeit an oyster veneering, a new fashionable finish at the time. During the restoration all other doors on the ground floor were repainted following the style of this historical graining; using modern tools, materials and techniques.

In the former palace of Princess Mary Louise of Hessen-Kassel, today known as the Princessehof Museum in the town of Leeuwarden, the Nassauroom (1731-1765) is decorated with gilt leather. This room is one of the many where the research method of historical finishes identified various faux finishes under a modern blue coloured finish (figures 5a, b). In this case they presumed to match the mid-eighteenth-century gilt leather and these imitations were reconstructed, again using modern tools, materials and techniques (figure 5c). Repainted versions do not always resemble the historical situation and raise the question ‘to what level are the repainted rooms a wonderful exam-

A meeting was organised at the annual Kleurhistorisch platform (a forum on painted historical finishes) to explore the question ‘What do I need to be able to paint or - let someone paint - a historical imitation well?’

To get consensus between the 130 different participants covering a variety of professions and their individual opinions – we used a Socratic debate. The outcome represents five so-called general, commonly held truths. The outcome was that getting it right is all very much about co-operation. The most relevant ‘truth’ for this article on repainting imitations turned out to be ‘good research and good execution’. In this section ‘good research and good execution’ will be specified.

Good research and good execution are defined at the forum as requiring five specific actions. These actions are related to each other and are set out below.

I. Uncover larger areas of the historical imitation.
The repainting of a faux marble on an altar in Museum Our Lord in the Attic in Amsterdam is discussed at the Forum. Figure 6a shows the altar before restoration. In figure 6b the altar is covered on the left side with a white preparatory ground layer. On the right – large areas of over-painting have been taken off – to uncover the original marble imitation. In this way the copier had immediate reference to what the marble should look like. Figure 6c shows the result. It is not always possible to uncover sufficiently large areas; due to lack of financial resources or time limit or because removal of the historical layers is not eligible.

II. Use paint analysis.
Paint research on a wooden portico dated in the mid-eighteenth century revealed faux finishes in red, white and, seemingly, black marble (figure 7). It turned out it wasn’t black at all. The layer structure consists of a white ground layer covered with a layer with blue smalt pigment covered with a transparent glaze of a red lake. Both the small
and the red glaze aged during time to colourless darker paint layers, giving the impression of a black paint.13

III. Make mock-ups (figures 8a, b).

The result of mock-ups, based on the research discussed above, was something completely different: a purple coloured imitation (figure 8a). Through mock-ups the painter gets a better understanding of the layers found in the paint analysis and of the desired effect.

IV. Collaborate.

An organ in the Organ Museum in Elburg. It is a composite organ - composed of different organs made into one. Without paint it looks like patchwork. Some parts date from the mid-nineteenth century. These parts had but few paint fragments. The paint researcher explained her research of the historical finishes at the Forum and talked about assumptions and misunderstandings.14 She had suggested in her report the finish might be ‘oak graining’. The painter of the graining had a hard time matching the oak with these quite orangetinted historical colours. The researcher usually works in the beginning of a conservation project, and painter comes in last. Thus they do not get the chance to communicate. Luckily in this project they had a benevolent client - there was room for interdisciplinary consultation, knowledge was exchanged as were joint experiences. Thus a better result could be achieved. The paint laid on the organ now imitates the light orange graining often found on church furniture in the middle of the nineteenth century.
Identifying and repainting historical graining techniques in interiors dated before 1800

V. Look into references of historical examples.
There are many kinds of historical references to be studied when repainting an imitation. Historical written sources in archives or, for instance, the seventeenth-century manuscript by Jacoba van Veen. Or historical examples that have survived time, such as ceilings and doors that had been covered with false ceilings or walls. Also the research done by others on historical references is valuable. Take, for instance, the research done by Jacco Hooikammer and Hans Piena on walnut-grained furniture in the nineteenth century, which has been repainted over the years and subsequently changed colour from red to almost white sometimes. Quantitative research like this and synthesis of research is essential for getting the bigger picture. And furniture research can be used as valuable references for architectural finishes as well.

Getting the bigger picture looking into historical examples
At the Cultural Heritage Agency of the Netherlands (RCE) I am involved in preliminary research on identifying and dating various historical painted imitations. The research aims at better understanding of painted faux materials, achieving appreciation of authentic painted faux materials in historic interiors, and making the case that conservation is as important as repainting them.

This section will focus in particular on visual effects of some eloquent and dated examples of wood imitations. Some examples include supporting paint analytical information or are related to information from written resources. I wanted to investigate if it is possible to visualise an evolution in the art of graining. If there is an evolution, a reference collection could help to understand undated and unidentified graining in the future.

Take, for example, the unidentified over-painted finish in an extravagantly rich decorated room in Huize de Dieu in the town of Alkmaar. Behind a socket a small fragment of a reddish brown finish can be seen (figure 9). Historical paint research showed that wood- and plasterwork in this room was all painted with this finish. The questions are what kind of finish could this be and could it be a graining? Attempts to uncover this finish have not led to good results. Subsequently, it is unknown what the finish originally looked like, as is often the case in the restoration of interiors. Early examples before 1800 are sparse. Historical written descriptions of graining methods are slight, but they do give subtle clues of...
what could have been imitated. We will look into this in this section.

The finish in this room is the starting point of the quest looking for specific developments in grain- 
ing. The room was commissioned around 1744. In terms of graining it is an interesting date. Although there are many written instructions using staining to counterfeit specific wood colours, there are none on film-forming graining techniques known in the Dutch language from that period. The first known Dutch manual that looks into these techniques was published by the Amsterdam painter Lambertus Simis in the early 1800s. It is particularly interesting as Simis uses the practical knowledge he gained from 1765 and onwards. He describes a new graining technique invented in 1740. It was used to paint the most prominent rooms and halls in the Netherlands. In the beginning, he states, it usually imitated a dark coloured wood, finished with a durable and high gloss amber lacquer. He mentions French walnut to be one of the first types of wood in this fashion. A newly invented graining technique is also known to have been introduced in England and France in the late eighteenth century and early nineteenth century. In 1828 the Englishman Nathaniel Whittock also refers to innovative nature of the techniques in his manual. Interestingly, he additionally mentions outdated graining fashions and materials, e.g. walnut graining and amber varnish, which he states is no longer in use and has been replaced by copal varnish.

Simis calls the new technique ‘gladhouten’, which could be translated as ‘making smooth or (French) polished wood graining’. Simis writes ‘gladhout’ counterfeits fine smooth wood with paint. Other sources from this period or later also use this terminology to describe furniture being painted ‘gladhout’. Simis gives instructions to counterfeit the ‘gladhout’ technique for walnut by brushing a duck’s feather or quill through a translucent glaze,
resulting in the distinct figures of walnut. If we can believe Simis the feather was used for graining since circa 1740. Thus it is remarkable, the use of a feather is a relatively new tool for Whittock in 1828. He writes he had just recently heard of its use. The glaze Simis mentions consists of one part of ground pigment in raw linseed oil, one part boiled linseed oil diluted with turpentine. Besides walnut Simis gives instructions for other ‘gladhouten’ techniques additionally using brushes next to the feathers: oak, mahogany, amboyna, olive, tulipwood and cedar, 30 using the same oil glaze to create them. Curiously, most of these types of timber were already simulated with paint before 1740, as we will see later on. Thus the question is raised to what extent ‘gladhouten’ broke with earlier techniques. What does ‘gladhouten’ mean exactly? Simis provides some additional information, as he explains what ‘gladhouten’ is not. He explains a technique used before 1740, the so-called ‘arabiën’ or ‘wortelwerk’. This could be translated as ‘arabiën’ or ‘burl work’. It is tempting to link the name to the use of gum Arabic, as Simis describes ‘Arabiën’ to be a water-based imitation technique, but Simis does not confirm this. This technique is still used in the 1800s as Simis gives instructions to make it in different colours, e.g. blue. It is imitated by means of rolling and turning a pig’s bladder - or that of an ox - through a thin coloured wash on a white or slightly tinted ground layer. Simis usually uses burnt umber mixed with vinegar or beer. Simis explains the essential ingredient of the beer to be the sticky substance, not the alcohol. As does Nathaniel Whittock, who also describes a similar technique, referring to it as a distemper of beer. However, Whittock does not use a bladder and moreover uses the beer distemper with which he made paintings (‘maeligien’) or strokes with a stick, as if it was a foreign timber. After it was varnished it looked well, according to Van Mander.

Surviving graining examples before circa 1800

With these different techniques in mind we will now take a look at graining examples dating from the second part of the sixteenth century to 1800. One of the oldest known dated graining in a Dutch interior is painted on a timber frame of oak with a pine ceiling of a rare early Renaissance house (c. 1565) in Amsterdam (figure 10a). Only small fragments of original painted surface remain (figure 10b). The fine curved lines are painted on a dry yellow orpiment-containing paint layer. The lines also contain some orpiment mixed with dark ochre and some red iron oxide (figure 11c). The pigment orpiment is available in Europe since the late Middle Ages. It was appreciated for its distinct lustre giving the surface a vivid golden hue. It is said to be not so suitable in oil. Surprisingly, the binding media have been analysed and found to contain protein but mostly oil. Even the chalk ground seems to contain some oil. Some samples show a finish with a varnish. The varnish was not analysed. Visually there are no features of ‘arabiën’ to be seen. Neither can we see ‘arabiën’ in a ceiling constructed of a grained timber frame of oak and pine floorboards in the house Oudezijds Achterburgwal 199 in Amsterdam (figure 11a). This ceiling is presumably from the same period or a little younger than the previous example. The graining looks as if it was painted with a brush on the yellow layer when it was dry (figure 11b). Again the yellow background colour contains orpiment. The analysis did not detect oil this time, but found some cholesterol which indicates that the binding medium could perhaps contain egg. The report does not mention a varnish.

The municipality of Den Bosch commissioned pigment analysis of some salvaged building fragments. Two of these fragments are decorated with graining. One of them is a secondary beam from a house in the Verwerstraat 24, it is dendrochronologically dated to 1619 (figure 12). The wood does not seem to be sanded or primed. A chalk ground had been omitted, instead a red layer was painted...
directly on the bare wood. On top of a dry ochre layer a plain dark graining has been painted with opaque colour. The other grained beam is from Korenburgstraat 16 (figure 13). The opaque graining is the first finish and has been overpainted several times. The wood is sealed with a chalk ground. The graining has a more elaborate composition, three body colours are used to create the figuring. Because of this, and the saturated paint used, it is assumed it is an oil painting and thus of a later date than the previous examples, presumably around the mid-seventeenth century. No signs of ‘arabiën’ here, neither of varnishes.

A shutter in the former town hall of Amsterdam (currently the Royal Dam Palace) shows a graining likely dating from the first building period (1648-1665) (figure 14). It is identified by the researcher as rosewood. Rosewood was very popular in this period. In Dutch it was often referred to as ‘sakkerdaan’. The brownish red coloured background layer contains lead white and red ochre and some umber. The figuring is described as ‘black stripes applied in a swift manner’, and consists of a translucent reddish brown glaze or wash consisting of a large amount of (unanalysed) binding media and small amounts of lead white, quartz and chalk. An unusual composition. The wooden substrate was prepared with a chalk ground. There was no varnish detected. Compared to the earlier graining references on the ceilings this graining looks different. Not only because of the colour, which is darker, also the figuring is different. It looks like a glaze evenly spread on the whole surface and manipulated to look like wood grain. It is not certain from pictures or from the report but the figuring does not look like brush strokes. Could this be a glaze, manipulated with a bladder? Could this be what Simis describes as ‘arabiën’?

Slightly similar features can be seen on the rear side of a panel painting by the artist Norbert van Bloemen, dated around 1730 (figures 15a, b). This can very well be ‘arabiën’. The only way to find out
Conclusion: distinguishing different techniques through time

Can we distinguish the two main techniques next time we look at new discoveries of graining in order to repaint them? It’s quite obvious by now that we need to know how the imitations were made and what materials were used in order to be able to recreate them. So first we have to find out if it is a building up in body colour, a glaze or wash either in ‘arabiën’ or ‘gladhout’ manner. This can be understood by uncovering larger areas of the original graining. Secondly, systematical technical analysis needs to look into the pigments and binding media of the paint layers, glazes or washes and varnishes.

In the Dutch language the first known description of a graining technique dates from 1604. The oldest surviving examples show wood figure which is painted on a dry ground layer or in a building up of body colour. There is an omission in written instructions on graining, in contrast to those that are given for the art of staining. Material analysis on graining from the end of the sixteenth and the early seventeenth century show ground layers containing orpiment, resulting in a sparkling imitation.

The first instructions in a Dutch painter’s manual are of ‘arabiën’, a technique using a bladder to manipulate the beer distemper probably to look like burl wood. From the mid-seventeenth century on imitations using a glaze or wash of different mixtures can be identified. Some of these examples might be ‘arabiën’. They seem to imitate burl, oyster veneering or rosewood, fashionable wood species at that time.

A new technique dating from around the 1740s is described, called ‘gladhouten’. The exact definition of this technique remains unclear. Especially because it is uncertain in what way it differentiates from the technique of ‘arabiën’, apart from the innovation of using a feather next to the more common use of brushes. ‘Gladhouten’ is perceived to be the technique still practiced in the trade. Consisting in a buildup of a smooth coloured ground layer, an oil glaze or beer distemper to manipulate into a typical wood figuring, removing and adding paint, finished with a varnish. The first timber to be counterfeited in this way appears to be walnut.

A continuous development seems undeniable. Further research could help make a reference collection to support future reconstructions. When making reconstructions such historical references should always be looked into, not forgetting to collaborate with other specialists in the field in the future will be to make mock-ups and have a closer look at the objects themselves.

Inspired by Simis’ instructions I have started working on mock-ups. I was triggered by what Simis writes on early ‘gladhouten’. He imitates walnut using a feather or a wing of a duck. Stroking it through the glaze he says it gives figures like French walnut. Simis emphasises that the right and left wing have a different character, the right giving a smoother effect. I could not resist trying this out and asked a befriended hunter, who shot me a duck. I had right and left feathers to my disposal and tried them out. And indeed they act differently! A pig’s bladder in my refrigerator is still waiting to be tried out as well.

As for the finish in Huize de Dieu, only a larger uncovered area will tell us if this finish is indeed a graining and if this is perhaps painted using either a bladder or a duck’s feather and thus being ‘arabiën’ or ‘gladhout’. Besides that, analyses of the binding media must be done in order to understand what we are dealing with. Especially if a satisfactory reconstruction is desired.

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The first instructions in a Dutch painter’s manual are of ‘arabiën’, a technique using a bladder to manipulate the beer distemper probably to look like burl wood. From the mid-seventeenth century on imitations using a glaze or wash of different mixtures can be identified. Some of these examples might be ‘arabiën’. They seem to imitate burl, oyster veneering or rosewood, fashionable wood species at that time.

A new technique dating from around the 1740s is described, called ‘gladhouten’. The exact definition of this technique remains unclear. Especially because it is uncertain in what way it differentiates from the technique of ‘arabiën’, apart from the innovation of using a feather next to the more common use of brushes. ‘Gladhouten’ is perceived to be the technique still practiced in the trade. Consisting in a buildup of a smooth coloured ground layer, an oil glaze or beer distemper to manipulate into a typical wood figuring, removing and adding paint, finished with a varnish. The first timber to be counterfeited in this way appears to be walnut.

A continuous development seems undeniable. Further research could help make a reference collection to support future reconstructions. When making reconstructions such historical references should always be looked into, not forgetting to collaborate with other specialists in the field in

The imitation may consist of the following layers

- a top coat
- a coloured glaze or wash
- the figuring (brush strokes, glaze/wash)
- a coloured layer
- a preparational layer

Table 1

<table>
<thead>
<tr>
<th>Each layer has its own features ranging from:</th>
</tr>
</thead>
<tbody>
<tr>
<td>tools to apply the layer</td>
</tr>
<tr>
<td>pigments to colour the layer</td>
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<tr>
<td>binding media</td>
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<td>time of application</td>
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<tr>
<td>technical skills or instructions on how to...</td>
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<tr>
<td>composition</td>
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<tr>
<td>e.g. alla prima</td>
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<tr>
<td>apply the layer</td>
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<tr>
<td>manipulate the layer</td>
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<tr>
<td>finish the layer</td>
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<tr>
<td>e.g. paneling or grisaille</td>
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</tbody>
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Table 2
order to gather as much information as possible. And
last but not least it is prerequisite to make lots of
mock-ups using all the gathered information of
the subject to gain more knowledge.
I am grateful for those who have shared their find-
ings generously by presenting them or making sure
they were published. It results in the prospect that
an evolution might become visible in the art of imi-
tating. Sharing more reference material will defi-
nitely help us to get the bigger picture.

Acknowledgements
Thanks to Jim Mooney for proofreading.

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Notes
1 The project joins up with a Vidi-project financed by The Netherlands Organisation for Scientific
Research (NWO) called ‘From Isolation to Coherence’, see http://www.nwo.nl/en/research-
and-results/research-projects/NWO/30/6530.html (retrieved December 2016).
2 Film-forming paints that can be either diluted in water, spirits, oil or turpentine are the topic of
this study, staining techniques are not.
3 Many authors write it is especially in vogue in specific periods. Instead I would prefer to specify
the periods when faux painting is out of fashion, e.g. during the Interbellum period and post-WOII
until the eighties.
4 B. Crijns, ‘Inzicht door imitaties in zicht: het imiteren van kostbare materialen. II. Hout’, in:
5 Glaze usually refers to an oil medium, wash indicates it is water-based.
6 Examples of ‘blotevoetenmarmer’ finishes are found in the more wealthy interiors, it is not
pre-eminently a rural practice as is frequently thought.
7 During the symposium the question was asked if this technique is known in other countries and
if so, what it is called there. There are examples known in Belgium, kind communication Charles
Indekeu.
8 In the last decennia this research has become a separate profession, with international confer-
ces resulting reference publications. The latest is Lisa Nilsen, Kathrin Hinrichs Degerblad (eds),
9 Hans Michaeelsen and Ralf Buchholz, Vom Färben des Holzes, Holzbeizen von der Antike bis in
die Gegenwart, 2009, pp. 96-98. Jongsmas, Ruth, ‘Kleuronderzoek Trompenburg, Corps de Logis,
10 http://www.collectiewijzer.nl/2016/04/05/wat-
heb-ik-nodig-om-een-imitatie-van-een-imitatie-
uit-te-laten-voeren/ (retrieved December 2016).
11 Socratic Method is described on wikipedia:
(retrieved December 2016).
12 www.collectiewijzer.nl > verslagen > kleurhis-
torisch platform (retrieved December 2016).
13 Willeke Jeeninga, De Ridderikhoffpanden in Hoorn; Roodt Sten 9, Groot Oost 3 en 5 Van beet tot dag-
menu, 2011.
14 www.collectiewijzer.nl > verslagen > kleurhis-
torisch platform. (retrieved December 2016).
15 See figure 7 (p. 88) of the article by Jacco
Hooikamer and Hans Piena, ‘The dynam-
ics of tradition. Painted vernacular furniture
by Miko Vasques Dias, Vernacular Furniture.
Context, form, analysis. Proceedings Ninth
International Symposium on Wood and Furniture
Conservation, 2008.
16 The room is a case-study in the research project
‘From Isolation to Coherence’ in which the RCE
participates. More information on this project can
be found at www.fromisolationtocoherence.nl.
17 In combination with a gilded and glazed chim-
ney. H. Sigmond and R. Keppler, unpublished
‘Rapport Kleurhistorisch onderzoek Huize de
18 Ige Verslype e.o., ‘The Original Appearance of
the “Painted Chamber” in Huis de Dieu, Alkmaar
(1742-1744) The Discovery of a Remarkable
Finish’, hitherto unpublished article for: the
Architectural Paint Research Conference March
2017.
19 Hans Piena, ‘Mahoniegehoute witwerken: imi-
taties van materiaal, constructie en functie’, in:
Cr, jrg. 4, nr. 2 (2003), pp. 48-69.
20 An elaborate archive of the house has survived
including painters’ bills. An article on this is
being prepared by Verslype 2017.
21 Merel van Schrojenstein Landman,
‘Herkenbaarheid van houtimitaties uit de peri-
ode 1750-1800 in de Noordelijke Nederlanden’,
unpublished Master’s thesis, University of
Amsterdam. Inske Immink, ‘Rode transparante
mahoniekleurige afwerklagen op eiken meu-
belen uit de periode 1770-1870’, unpublished


24 Simis 1801, 238-243. This corresponds with the observations on graining before 1800 which Hans Piena writes about in: Piena 2003, 48.

25 Ian Bristow, Interior house-painting colours and technology, 1615-1840, p. 53.

26 Nathaniel Whittock, The Decorative Painters and Glaziers’Guide, 1828, p. 20: ‘the very great improvement that has been made within the last ten years in the art of imitating the grain and colour of various fancy woods and marbles, and the facility and consequent cheapness of this formerly expensive work, has brought it into general use (...)’

27 Whittock 1828, pp. 39 and 86. In other sources ‘gladhouten’ is also being used to describe French polished wood.

28 ‘Een buffet, vroeger, toen het zijn rood bruin verlaksel nog had, sprekend op gladhout gelijkend (...)’ in the past the buffet greatly resembled ‘gladhout’ when it was still covered with red brown lacquer in: De Gids. Jaargang 20, 1856, p. 245.

29 Whittock 1828, p. 42.

30 Whittock 1828, pp. 39-86; For oak and mahogany he gives more than one recipe: uncoloured wainscot, planed oak, wax polished oak or brushed with oil and varnished, oak tinted brown, [Relatively] new prepared mahogany, old or aged mahogany. The recipes of timbers by Nathan Whittock are partly comparable partly more comprehensive: oak, mahogany, satin wood, walnut tree, rose wood, maple, coral wood, satin wood, in: Whittock 1828, pp. 20-28.

31 Whittock mostly uses beer distemper and only mentions oil glaze in his instructions for oak imitations. He does not use a fluid oil glaze, but a compound of various ingredients mixed togeth-

Egg tempera has been identified on a painted panel that forms part of a set of coarse white yarn cloths painted to simulate wood paneling. They were discovered in the upper room of The Lockers, at Hemel Hempstead, Hertfordshire and now part of the collection of the Victoria & Albert Museum, inv. nr. W.41-1952. [http://collections.vam.ac.uk/item/O79020/fragment-of-a-unknown/](http://collections.vam.ac.uk/item/O79020/fragment-of-a-unknown/) (retrieved December 2013).

Binding medium analysis was omitted. SRAL, ‘Oriënterend microscopisch onderzoek van beschilderde balkenplafonds in Den Bosch’, research and report: A. Friederichs, SEM-EDX analysis: R. Hoppenbrouwers, Dr. Paul van Kan, unpublished report, June 2014.

Due to the coarse lead white pigments in the paint layer and the rosewood imitation.


It can be spelled in many ways, as Iep Wiselius shows in his article: Iep Wiselius, ‘De jacht op sakerdaan’, in: Proceedings Stichting Ebenist, [Houttechnologie voor meubelrestauratoren](http://collecetions.vam.ac.uk/item/O79020/fragment-of-a-unknown/), 2005, p. 61. The natural wood was used in this period, but it was also imitated with paint.


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- Leonieke Polman
Marble, tortoiseshell, wood and other materials created in paint and lacquer during the Baroque period in Denmark

Berit Møller

Introduction

Faux marble created with paint has been known since ancient times. However, in the Baroque period (1660-1740), marble, wood, tortoiseshell, and other rare or expensive materials were imitated with the aid of paint and lacquer. The production of painted faux materials on surfaces of furniture and interiors was not only a matter of saving money on very expensive materials. To produce things that were not what they seemed to be was a very popular topic in the seventeenth century.

This paper attempts to get a clearer picture of the development of material imitation in Denmark in the Baroque period. The setting for this investigation is two of the royal palaces in Denmark. In Rosenborg Castle in Copenhagen and Fredensborg Palace north of Copenhagen there are several examples of painted faux materials. They were executed in the period from 1663 up to the 1730s by a small number of specially trained painters – marblers or lacquer masters - working for the Danish king.

The study covers four main areas:

• The treatises and recipes that describe methods and materials which the painters might have known and used in their work.
• Examples of imitations are examined through Architectural Paint Research (cross-sections and uncovered surfaces).
• The lacquer masters who manufactured faux materials on objects and interiors for the Danish king.
• The origins of the design of the imitations. Did the painters have real stone samples, tortoise shell etc. to work from, or are the imitations from this period pure fantasy?

Imitation in the Baroque period

Since classic times, trying to imitate nature has been a challenge for the painter. Executing the imitation so well that the spectator is tricked into believing that genuine materials have been used. The seventeenth and eighteenth centuries were a golden period for the art of imitating materials that were used for decorating a surface on either a wall or a piece of furniture. Why this is so, is not clear, but there are some indications that the imitations are somehow linked to the introduction of the imitation of Asian lacquer.

The encouragement to imitate Asian lacquer starts with the shortage of genuine Asian lacquerware on the European markets. As early as around 1610 the Dutch entrepreneur Willem Kick is making Asian lacquer imitations on boxes of various sizes.

The scant general knowledge of Asian craft and fashion determines the motives which are painted on the lacquerware as well as the materials and methods used. This results in items picturing the European idea of Asian decoration instead of being a proper imitation. As time passes, and the knowledge of Asia increases, the quality of the imitations improves.

Even though the Europeans don’t have much knowledge of Asian urushi lacquer in the early part of the Baroque period, they manage to produce quite a presentable imitation of the surface of Asian lacquerware. However, they use materials which can be purchased in Europe and with which they have experience. This ‘japanning’ probably inspired craftsmen to mimic other materials with comparable glossy, hard and smooth surfaces such as polished marble, polished tortoiseshell and polished wood.

The treatises and recipes in the Baroque period

It is a fact that the treatises of the seventeenth century list the art of japanning right next to the art of marbling and creating faux tortoiseshell, as is seen in the two early publications Polygraphice - The Arts of Drawing, Engraving, Etching, Limning, Painting, Varnishing, Japanning, Gilding, etc., by William Salmon, first published in 1672, and A treatise of Varnishing and Japanning, by Stalker and Parker, published in 1688. Both treatises use the same materials and methods for japanning as well as for marbling, faux tortoiseshell and other materials. The oldest Danish recipe book dealing with the subject is called, in translation, ‘A short and detailed instruction on how to prepare lacquer and how to japan’.

Marble, tortoiseshell, wood and other materials created in paint and lacquer during the Baroque period in Denmark
colours’. The book was published in 1746 by an unknown author.

Examining the recipes in these publications we find which materials and working methods were recommended. But even though these publications are quite detailed we cannot be sure that the author completely understood the working process or the materials, since the recipes often were translated from another language or just copied from an older work. It is also likely that the knowledge of a method went from master to apprentice. Through the generations experience grew and new smarter methods were developed.

One of the earliest recipes I have been able to find regarding the imitation work of marble, tortoiseshell etc. is found in the publication by William Salmon. In this book there are a number of imitation recipes. Salmon presents us with examples of what usually is imitated in the following introduction to the subject: If you are to imitate anything, as Amber, Lapis Lazuli, Marble, Tortoise shell, etc. you must first make the imitation of them upon that which you would Varnish. With their proper Colours, as in Limning or Painting with Oil, which must be throughly dry: then by the former section go over all with the Varnish so often, till you see it thick enough, letting it dry every time leisurely.

The recipes for marbling
Salmon presents two recipes for marbling. They represent two different methods where the layer structure consists of different binding materials. Both recipes are for a white marble with black veins and grey clouds:

• Distemper painted motives finished with layers of lacquer to obtain a high gloss
• Motives painted solely with layers of lacquer

Stalker & Parker present only one recipe and it resembles the first of Salmon. The contents and the phrasing are almost the same, so Stalker & Parker must have copied the older work. The two oldest Danish recipes on marbling from 1746 only refer to the lacquerwork itself. In these recipes the author describes exclusively the manufacture of the finishing lacquer layers of a black marbling and of marbling with other colours. How to produce the black and coloured marbling – the ground layers with painted veins and other details – is not mentioned at all.

Recipes for tortoiseshell
Salmon presents four ways to imitate tortoiseshell. They represent four different methods where the layer structure consists of different binding materials:

• Ground: Leaf silver. Flames: Glue paint and coloured lacquer. Finish: Lacquer
• Ground: Leaf silver. Flames: Oil colours. Finish: Lacquer
• Ground: Red and yellow colour. Flames: Coloured lacquer. Finish: Lacquer
• Ground: Red and silver or gold colour. Flames: Coloured lacquer: Finish: Lacquer

Stalker & Parker present two recipes. Both of them are inspired by Salmon’s recipes 1 and 3. However, Stalker & Parker are also supplying more advice on choosing methods and materials, and they give a small history lesson on the fashion of tortoiseshell. The Oldest Danish recipe on tortoiseshell from 1746 is somewhat different but resembles to a certain extent the third of Salmon’s recipes as the ground for this tortoiseshell is not a layer of silver but a red ground. The flames are made with glue paint and the colours are applied from the lightest colour towards the darkest, which is opposite of all the former recipes. 3 The imitation is finished with several layers of lacquer which are polished and finished with a last layer of clear varnish.

Other recipes
In the treatises there are a magnitude of different varnish recipes which cover a wide spectrum of optical effects: coloured lacquers, such as red, blue, green, yellow, olive-coloured, chestnut-coloured, and white. 4 Lacquers for wood without colour. Imitation of Indian lacquer, Bantam work, lacquer for Japanese and Chinese golden figures and gold or silver speckles in lacquer (aurotine lacquer). Imitations of lapis lazuli stone, marble, tortoiseshell. Imitation of amber is mentioned but not described in detail. Imitation of porcelain is described in the Danish treatise from 1746. In the early Baroque treatises there is no mention of how to manufacture faux wood, however, several examples of this are to be found in the Baroque period in Denmark. 5

Methods and materials
Analysing these early recipes we find that they strive to imitate the real material, it being marble or tortoiseshell. For example, regarding the imitation of tortoiseshell it is recommended to have a little piece of shell next to you when you work, in order to make the imitation as correct as possible. 6 The recipes vary from complex mixtures and methods to more simple ones. Some are only semi-com-
Marble, tortoiseshell, wood and other materials created in paint and lacquer during the Baroque period in Denmark

Colours:  
Silver leaf,  
Flake white, or white Lead,  
Vine Black, Lampblack, ivory-black  
Cologne Earth, Collins Earth,  
Sanguis Draconis, Cambogia,  
Umber  
Brown Pink  
Tincture of Verdigris  
Vermilion,  
Auripigment,  
Cinnabar  
Indian Lake, Lake

Binders & Solvents:  
Ising-glass Size  
Parchment Size  
Gum-water  
Glue water  
Water  
Size or Glair  
Glue oil varnish  
Turpentine spirits  
Oil ground for gilding  
Tepentine Varnish

Lacquers:  
White Varnish (gum-Sandarack, Venice Turpentine,  
Gum-Copal, Mastische, Benjamin, Gum-Elemi, white Rosin)  
Seed-lac Varnish  
Bernstein (amber)  
Gum uspal (?)  
Gum Ammoniacum,  
Gum copal  
Lacca Varnish  
Common Varnish  
Florentine lacquer, Kuglelak

Figure 1  List of all materials used in the early and later Danish Baroque recipes for the imitation of marble and tortoiseshell.

The ground layer  
All recipes describe a smooth ground made of glue paste of some sort. On top of this a colour is applied which is giving the imitation the right glow. Silver is in this context regarded as a colour.

The veins and flames  
After this, the structure of the imitation is roughly divided into three methods:  
1. The imitation is applied solely in lacquer layers which are polished.  
2. The imitation’s first layers are executed with either oil paint or distemper (various sorts). When the motif is finished several lacquer layers are applied and polished.  
3. The imitation is started as method 2. But only the first detailed layer of the imitation is performed in distemper or oil. The following layers are made with coloured lacquer. Again when the motif is finished several lacquer layers are applied and polished.

The three methods result in imitations with a slightly different expression. The distemper and oil marbling can result in a rather flat imitation with only little depth. The method with many coloured lacquer layers, on the contrary, has a certain depth in the image. The large amount of lacquer layers also enables polishing into a high gloss.

Baroque imitations in Denmark  
In the Baroque period imitation was very popular in Denmark. Interiors and furniture were richly

Figure 2  Rosenborg Castle. Painted by Johan Jacob Bruun, c. 1740.
decorated. The royal palaces represent very fine examples of fully imitated interiors and furniture. Especially Rosenborg Castle, Frederiksberg and Fredensborg Palaces offer numerous examples. In the last fifteen years a number of decorations at Fredensborg Palace and two of the rooms with imitations at Rosenborg Castle were examined by Archaeological Paint Research. Together they show the development from the earlier Baroque period to the later part. In the following, details of this development will be presented.

The early Baroque imitation methods
One of the oldest examples of faux material from the Baroque period we find at Rosenborg Castle in Copenhagen (figure 2). In 1667, the royal bed-chamber was renovated in one of the most fashionable styles of the time: Chinese lacquer with a golden decoration and tortoiseshell imitation. The Chinese decoration lacquer I will not get into at the moment, but I will concentrate on the tortoiseshell (figure 3).

This tortoiseshell was painted on the framework of the existing oak wood panelling in the original bedchamber of King Christian IV, some years after he had died. The new king and queen had the room renovated in a new style. To carry out the renovation the king chose the Dutch lacquer master Francis de Bray, who came to Denmark at the king’s request in 1663. De Bray had just finished his first Chinese-inspired interior decoration in black and gold colours with raised and inlaid work in one of the tower chambers when he started the decoration of the bedchamber. This was to be another Chinese-inspired interior: Chinese golden motives on a blue-green ground with the framework covered with faux tortoiseshell and silvered mouldings.

The wooden wall panels were covered with a layer or two of glue paste ground which was carefully sanded and smoothened. Markings of each piece of faux tortoiseshell to be painted were cut into the ground adding to the imitation (figure 4). When regarded in raking light the surface shows the edges of the tortoiseshell pieces. This feature is rarely seen in the creation of painted faux material in Denmark, but it gives an almost three-dimensional, very lifelike look to the surface.

The structure of the imitation itself was analysed through a series of cross-sections sampled from one of the painted doors. The first paint layer on the glue paste ground are three layers of pinkish and orange yellow colour (figure 5). The first two layers are fairly thin while the third layer is thicker. We have yet to discover if these layers are painted with distemper or oil colour. On top of these three layers is the first layer of lacquer. It is a thin layer with a dark brown, almost black colour. A much thicker layer of lacquer follows. It seems to be another sort of lacquer because in UV light it has a different florescence. This layer has a yellow colour. It is very thick and the top of the layer is smoothly sanded. The next layers of lacquer are much thinner and have even thicknesses. They have slightly
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different colours ranging from medium brown to light yellow and their UV florescence is also slightly different. Typically, a coloured layer is surrounded by colourless layers. There are up to six of these thin layers. In total the tortoiseshell imitation has been built up by at least nine layers.11

Examining the cross-sections from the room paneling it is clear that the method used by De Bray is a fairly complex method involving the application of many layers of various types with frequent sanding in between.

The king’s lacquer master also executed the marbling in the marble room at Rosenborg Castle (figure 6), which was decorated in 1667-1670.12 This marbling was created on the doors while the walls were covered with stucco marble – another
Imitation technique. The design of the marbled doors resembles the design of the stucco marble. However, the intensity of the colours differs. Also note that the colours of the stucco marble – mainly the red and yellow colours – have degraded into grey colours, while the marbling on the doors is in a very good condition.

The marbling is built on a thin, smooth glue paste ground. A design for the faux marble pieces has been cut into the ground in order to resemble the edges of the various pieces of marble. Also here the result is quite an effective illusion when you observe the marbling in raking light. Each type of marble – there are four different stones – consists of various numbers of layers according to the type of marble being imitated (figure 7). The application method of the layers also differs: some are painted wet-in-wet (a la prima) while others are painted on a dry layer. Some layers have been dabbed on while others are applied with a brush. The different effects are used in order to imitate the stone. The paint materials must have been fairly non-viscous because often drippings are seen. The layers are all executed in lacquer. An examination showed that the marbling consists of up to nine different types of layers. Some of the layers seem to have been sanded and smoothened, and eventually finished by application of one or more layers of clear lacquer.

The faux tortoiseshell in the Chinese bedchamber and the marbling in the marble room are examples of imitations from the early Baroque period. They represent methods that come close to the methods described in the treatises of the same period (Salmon and Stalker & Parker).

Figure 8 Fredensborg Palace. Painted by Johan Jacob Bruun, 1739.

Figure 9 The altar at Fredensborg Palace Church. The marble work in the church was made by the king’s marbler Elias Green.

Figure 10 Detail of the top decoration.
The later Baroque imitation methods

In Denmark we also find imitations of various materials in the later part of the Baroque period. At Fredensborg Palace (figure 8), which was inaugurated in 1722, the imitation works were created by another of the king’s marblers, Elias Green. He worked at the palace several times. In 1727, he created what is known as his main work in the church of the palace. His signature is incorporated in the marbling on one of the columns of the altar (figures 9-11). Almost all doors of the main palace were executed with wood imitations while the door frames were finished with various sorts of imitations: marble, amber and tortoiseshell (figures 12, 13) – various wood types and even a dark blue-grey which could be imitating steel (figure 14). Unfortunately, these decorations have later been covered with new layers of paint.

Other examples of marbling from the later Baroque period are found on a table (figure 15) which was part of the furnishings at another palace – Frederiksberg – which was finished in 1709 and rebuilt in 1729. In this palace the wooden parts of the interior were marbled. Even the furniture was marbled. A table from these interiors still exists.

Besides visual analysis and stratigraphic examination of several rooms in Fredensborg Palace the table has been uncovered completely; the results contribute to our knowledge of imitations from this period.

The visual analysis

Typical for this period are the colour richness and the large number of different imitations put together: marble next to amber or tortoiseshell. The same richness in decoration is seen on the table which is decorated with three different types of marble (the table top of real marble is a fourth type). On the doors two or three different wood imitations are mixed with coloured lacquer. The doors of almost each room have their own wood and colour combination.16

The points of visual identification for the imitations of this period can be summed up:

- ‘Material wealth’: many different types of imitations put together in one place.
- Contrast between the heaviness or lightness of the brush strokes.
- Contrast between the forms of the designs of the imitation (large and small shapes).

Figure 11 The marblings are signed and dated by Green: Marmorer Green Ao 1727.

Figures 12-14 Examples of the original faux marble, amber and tortoiseshell on the doors and door frames at Fredensborg Palace.

Figure 12 Uncovered finish on the door frames of the bedroom of the crown princess (now called the small Baroque dining room).

Figure 13 Uncovered finish on the door frames in the audience chamber of the crown prince (now the large Baroque dining room).

Figure 14 Uncovering on the door in the bedroom of the crown princess.

Figure 15 Marbled table from Frederiksberg Palace (now Fredensborg Palace).
• Contrast between a colour-heavy marbling and a ‘mildly’ coloured marbling or other imitation.
• Contrast between a heavy and a light reflected surface (gloss).
• The use of complementary colours (e.g. red > < green).

The use of lacquered and matte surfaces, faux tortoiseshell, amber and iron reflect a material wealth, and this variety of colours and patterns seem to be part of the baroque identity when it comes to the art of imitation in Denmark. The imitations seem to have in common that they are not broken down into pieces according to the ‘natural size’ of the materials, as we saw on the imitations at Rosenborg. However, the uncovered areas are small, and the windows give us a limited view, which makes it impossible to draw definite conclusions. On the other hand, the altar of the church and the uncovered table show no signs of breaks in the design, where one would expect faux joints.

The stratigraphic analysis
All of the uncovered areas and cross-section samples show that the imitations of the later Baroque period are built without a glue paste ground. A typical feature is that the preparation of the wood appears to be a saturation of the wood in the form of a coating of perhaps varnish or dark coloured glue. It is always painted directly on the woodwork. Minor deficiencies in the woodwork like knots or small holes in the surface are not always filled out. This layer of saturation of the wood is not found on the table.

The structure of the imitations on the table as well as on the doors and door frames start with a thin base layer. Usually, this first colour is a medium grey colour which is believed to be distemper. The grey colour is used as a cool tone for the following layers, and it covers the wood regardless of the type of imitation. In some cases this layer is slightly multicoloured. That means that the design of the marble is already outlined in this layer. The following layers are sometimes painted with distemper and sometimes a coloured glazing is applied locally. Typical is the roughness in the design of the veins of the marble. The brush strokes are often easily visible when regarded from up close.

A further common feature of this period is the use of glazes of lacquer for contouring areas around the veins, and creating weak and strong shadow glazings, mostly in a bright colour, which due to the thinness of the layer is only a hint. These shad-

Francis De Bray (1663-71, active in DK)

Christian van Bracht (1637-1720) licensed as Court marbler.
He could either have succeeded de Bray or they could have worked together from 1669-1711? Perhaps von Bracht came to Denmark to become de Bray’s assistant. CvB restored “The Princess” Lacquered Tower Room, Rosenborg 1716. (Weilbach)

Johan van Bracht (1684-1710), Marbler and japanner. Christian van Bracht’s son. Probably educated by his father, who he assisted in marbling and japanning at the royal palaces. (Weilbach)

Elias Green (d. c. 1736), marbler. Licensed as Court marbler 1712. Renewed 1731. Marbling and japanning in the royal palaces from 1716 at Rosenborg and from 1722 at Frederensborg. (Weilbach)

Carsten Tønder (1687-1761), Court japanner. Christian van Bracht’s son in law. Possibly educated by Christian van Bracht. Restored de Bray’s Chinese Bed Room, Rosenborg 1723. His licence was condemned in 1725. (Weilbach)

Figure 16 The king’s lacquer masters of the Baroque period in Denmark.

ow glazings exist in a kind of intermediate layer between the veins and finishing lacquer layers. Some of the marbling types have been built up with several lacquer layers of which some are coloured, some are clear, and even one is milky. On both the door frames and the table the number of layers differ from one type of imitation to another. On the table each type of marble is built with up to seven steps containing one or more layers.

On top of the coloured layers are found the finishing lacquer layers. In some places they are almost colourless (though often slightly yellowed due to decomposition), in some places they are pigmented: either bright or dark. On the table these last lacquer layers were sanded into a smooth even surface, while the surface on the door frames were rougher and only a few of them were sanded.

The kings’ lacquer masters in Denmark in the Baroque period
There is no doubt that the lacquer masters of the Baroque period who were employed by the Danish kings were highly skilled. In fact, when King Frederik III wanted to renovate the rooms at Rosenborg Castle according to the latest fashion he called for the Dutch lacquer specialist Francis de Bray. He worked for the king in Denmark for almost ten years before he moved on to Sweden. Another Dutchman became the king’s new lacquer master, Christian van Bracht. He stayed in Denmark and became the father of two sons who he trained in the art of lacquering. He probably also trained Elias Green – the marbler at Fredensborg Palace;
we know that they worked together at Rosenborg Castle in 1712. Van Bracht probably also trained his son-in-law Carsten Tønder, who became the king’s lacquer master after the death of Van Bracht (figure 16).

Lacquering was a special passtime for the royal family in Denmark in the Baroque period. There are several examples of lacquered items from the hands of members of the royal family in the royal collection at Rosenborg Castle. Most likely, they were taught and assisted by the king’s lacquer master.

The imitations and the real stone

The colourful and richly patterned imitations of the Baroque period have received many names, one being fantasy marble. The design of the Danish Baroque marbling has for many years been described as colourful, fantastic, peasant-like etc. Typical of the Baroque marbling are the colours, the fantastic patterns, the great movements and repetitions of the elements of the designs. Often you feel that the marblings are personal.

It is true that many of the marblings which are seen in seventeenth- and eighteenth-century churches, manor buildings and town houses are very imaginative. When you look at marblings from the townhouse Møntmestergården, originally in...
Copenhagen, now Den Gamle By in Århus (figures 17, 18) you understand the willingness to call these marblings fantastic. It is hard to see which sort of marble they imitate. Other examples are painted in the Great Hall at Selsø Castle, a manor house in the countryside in Denmark. And again it is not easy to identify which sorts of marble they are illustrating (figure 19).

However, the marblings were executed in a period where the aim of imitating was to trick the spectator to believe that the imitation was the real thing. The better the quality of the imitation the greater the trick. The king was at the top of the society’s ladder – he had the means to employ the best painters who were able to produce the perfect imitation.

Identification

Getting close to the marbling at Rosenborg Castle and Fredensborg Palace during the examinations of the palaces interiors it became a challenge to try to identify the sort of marble which could be the model for the marbling, in case they were not pure fantasy. Using several marble encyclopaedias, most of the uncovered marbling samples were more or less identified. 20

A number of limitations was established before the identification:

- Sample access: marble types from Europe and the counties around Europe were preferred.
- Sample size: the uncovered paint areas were limited, leaving a large degree of uncertainty. Also, the marble encyclopaedias themselves do not mention the size of the presented piece of marble.
- Sample colour: one has to take into account that the colours of the pictured marble sample can slightly differ from the real thing.
- The colours of the uncovered marbling may have changed from original due to degradation and later treatments.
- The uniqueness of the natural stone: it is impossible to find exact matches.
- Several uncovered marblings were digitally retouched to make up for damages from earlier treatments.

More than eighteen of well over twenty samples were identified, and despite the fantastic character of some, many marblings were identified to a large degree of certainty. Figures 20 to 27 show some of the marble types which were identified.

Having been able to identify the imitated marble it is tempting to think that the Baroque painter actually was copying real marble. There are more indicators for that. For example, the diversity of the marbled expression suggests that the painter has had some kind of original to copy or to use as inspiration. If the imitator had no original design to copy, it is possible that all marble types would look more or less the same or would not resemble real marble at all. To work from a given design or to copy was largely a method Baroque painters knew. The apprentice copied the master and the master copied the more prominent painters and so on. Therefore, it is reasonable to believe that even the
Marble, tortoiseshell, wood and other materials created in paint and lacquer during the Baroque period in Denmark

most prominent painters would have been in need of some design to copy, preferably real marble, tortoiseshell etc. - exactly what Salmon recommends in his manual. Freedom for the imitator would be in his interpretation of the sample.

Marble collections and inspiration sources

The uncovered marblings at Fredensborg Palace and on the table indicate that the size and amount of marble samples that were at the disposal of the painter may have been small. The size of the veins and typical characteristics are limited, and spread over a larger area. The green marbling on the table apron (figures 23, 24) suggests that the painter on occasion would integrate two or more marble types into one, either because he had only small pieces of real stone to his disposal, or to vary the expression. It is unknown if all marblers would have had their own (small) stone collection, but they could have had access to stones from other sources, such as the stone collections of their wealthy clients.

In the Baroque period furniture with inlaid stone, metal, wood, tortoiseshell etc. was often produced. A decorated table top, for example, is a small stone collection in itself. At Rosenborg Castle there are several examples of furniture with small stone collections (figure 28). In places like Fredensborg Castle the genuine marble fireplaces and marble door frames, in particular in the dome hall, could have served as an example too.

On large building sites painters might have had the opportunity to meet sculptors and other stone workers. Many craftsmen and artists at the royal construction sites came from abroad. They may...
have had stone samples from areas where it was easier to obtain marble samples. The painter (apprentice) who had no access to real stone was taught to marble by his master. He may even have never come close to a real piece of marble. This might explain why the marbling in town houses and country manors are further away from genuine marble than the marbling at the royal palaces.

Conclusion
When comparing the execution of the younger imitations at Fredensborg Palace to the older imitation at Rosenborg it is obvious that a development has taken place. The glue paste ground is no longer used, instead a thin layer of greyish distemper functions as a ground, which at the same time gives a darker cool tone to subsequent layers. The discarding of the glue paste ground is probably a result of experience. Often the seventeenth- and eighteenth-century treatises recommend a thin glue paste ground which is sanded to such a degree that the paste is left only thinly covering the grain of the wood. In the Chinese bedchamber at Rosenborg Castle the glue paste ground is fairly thick, and as a result the paint layer is constantly flaking. These damages have shown themselves at an early date, and examinations have shown that large areas of the original tortoiseshell imitation have been restored already in the Baroque period. The techniques seen at Rosenborg, where the marble is built up of only lacquer layers, are not present in later periods. The bottom layers, including the veins of the marble, are always made with distemper or oil and the coloured and transparent layers of lacquer are used as the top layers.

This development is also visible in the early treatises on the subject. These are only slightly younger than the examined samples at Rosenborg Castle. The Danish recipes which are about twenty years older than the samples from Fredensborg Palace describe only the manufacturing of the lacquer layers themselves – not the design layers executed in distemper. This could indicate that coloured lacquer layers showing part of the final design followed by several layers of clear lacquer was replaced by the execution of design layers in distemper followed by clear or almost clear lacquer layers applied on top. However, the examinations of the later Baroque imitations show that in the 1720s the coloured lacquer layers were still used in the build-up of the imitations before the application of the final lacquer layers.

When examining the recipes for creating imitation of various sorts it is difficult to establish a development in the use of materials. The list of materials seems to be fairly short and the main bulk of the materials are used across the whole period. The oldest recipes from 1672 already describe the use of different systems based on lacquer/lacquer, oil/lacquer, and distemper/lacquer. If we can see a development it must be rather a cut in the different techniques or methods and a simplification in the execution of the imitation. But this conclusion can not be drawn upon the small number of studied recipes from the later part of the period.

The materials used at Rosenborg and Fredensborg have not been tested, and a development in the use of materials has not been established. However, we hope to have the materials used for the imitations at Rosenborg tested in the future.
Marble, tortoiseshell, wood and other materials created in paint and lacquer during the Baroque period in Denmark

The art of japanning and creation of faux materials are often paired with the art of gilding. All three are present in the books by Salmon and Stalker & Parker. In Salmon and Stalker & Parker’s recipes the darkest colour is first applied and followed by brighter colours. In this case white equals the colour white. But usually in the treatises white means clear (like water).

Fredensborg Palace, the wood imitations are part of the original decoration on the doors of the palace which was inaugurated in 1722.

Salmon as well as Stalker & Parker recommend to use a piece of tortoiseshell when imitating this material.

This analysis is conducted on the previously presented recipes and not on the entire collection of recipes in the early treatises. Unfortunately, the marbling and faux wood in Frederiksberg Palace have to a large extent been repainted in the nineteenth and twentieth centuries.

Stratigraphic examinations – uncovered areas and/or cross-sections of the paint layers.

On this door there are at least two repair periods which were executed in the Baroque period. These repair periods will not be analysed in this context. The photo is showing a cross-section of the tortoiseshell imitation sampled in an area where only the original paint layer is represented. It is possible that there are even more layers in other areas. When you take samples for cross-section you work in a very small area and the area next to it might show a different number of layers – particularly in this type of painting where the colouring and layer thickness differ so much.

There is no archival evidence of De Bray executing the marbling in the marble room. However, the similarities in the execution methods of the Chinese bedchamber and the marble room strongly indicate the same painter. It is also known that De Bray stayed in Denmark at the time of the completion of the room.

A stratigraphic examination based on layered uncovering of paint by the use of solvents and a microscope. Each layer can consist of more than one application.

This diversity is also reflected in the rest of the interior, for example, in the painted panels and the highly coloured and/or patterned wall coverings.

In the 1960s a large part of one of the door frames, a door and a part of the panelling were uncovered and here no joints were found.

The original lacquer layers on the table unfortunately had to be removed due to extensive damage. The table had been painted several times and the original lacquer layer was damaged by sanding caused by the preparation of the second colour period. The original paint layer was uncovered in 2004.

A finishing lacquer consisting of many layers which have been sanded to a smooth and even surface is not seen on the door frames at Fredensborg Palace, which often have grainy surfaces. However, the archives show that when Fredensborg Palace was inaugurated the paint was still wet on the door frames and panelling which suggest that the execution of the decorations had been under some sort of time pressure to be finished. This could explain the less evenly sanded surfaces. If we look at the before-mentioned table from Frederiksberg Palace the surface of the wooden core is much smoother and the finishing layers of the marble were smoothly sanded too.


Archives show that two of the original four lacquered rooms (executed from 1663 to 1670) were restored in respectively 1716 and 1723.

References


Notes

2 The art of japanning and creation of faux materials are often paired with the art of gilding. All three are present in the books by Salmon and Stalker & Parker.
3 In Salmon and Stalker & Parker’s recipes the darkest colour is first applied and followed by brighter colours.
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13 Cinnabar and lead yellow.
14 A stratigraphic examination based on layered uncovering of paint by the use of solvents and a microscope.
15 Each layer can consist of more than one application.
16 This diversity is also reflected in the rest of the interior, for example, in the painted panels and the highly coloured and/or patterned wall coverings.
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21 Archives show that two of the original four lacquered rooms (executed from 1663 to 1670) were restored in respectively 1716 and 1723.
Koninklijk Oudheidkundig Genootschap, 1939.


Digital sources

- Weilbach, kunstnerleksikon, https://www.kulturarv.dk/kid/Forside.do;jsessionid=81EABDCDF16FA34F1985E85CE2200330
Abstract
In this article an alternative method for recolouring discoloured furniture is presented. The focus is on two discoloured pieces of furniture: an Amsterdam School buffet and a Rococo marquetry commode that both have lost their bright colours due to fading (figures 1, 2). The buffet was dyed with a mixture of synthetic dyes in a monochrome orange colour. The outside of this buffet has almost completely lost this bright colour, whilst the interior is still bright orange. The Rococo commode was composed of brightly coloured purpleheart and tulipwood veneers, and a dyed marquetry design of flowers in a vase. The commode has faded over time and is now characterised by hues of brown. It can be stated that both objects in their faded state no longer represent the original idea of their makers. At the same time, it is impossible to have complete certainty about the exact original colour hue of the dyes that were used; the concentrations of colourants that were used have so far been impossible to retrieve, and they have a significant effect on the overall colour. In general, a physical restoration is not considered a good option as it is thought to be too invasive, and reversibility is difficult to achieve. Such a restoration, in particular since the colours are not precisely known, is considered to be unethical.

This study aims to determine whether it is possible to create the illusion of a brightly coloured buffet and commode by projecting coloured light on the object. Standard presentation beamers in combination with projection mapping software were used. Because of its shape and monochrome colour the buffet was an easier case study and therefore a good start of this study, while the multi-coloured, bombé commode was more of a challenge. Good and realistic results were achieved as light imitates the qualities of dyed wood well. This paper describes the different steps to arrive at an accurate ‘retouching’ of the objects using coloured light. This includes chemical analysis, physical reconstructions based on historical recipes, degradation research, botanical identification of the flowers on the commode, a careful mapping of both objects, and finally the projection. Not all steps have been undertaken for both objects, however, we believe that the research strategies described can form a base for further studies.

Introduction
Our perception of colour is highly influenced by the light in which we see an object: the combination of the reflection spectrum and the spectrum of the light determines the colour. The aim of this study was to determine whether it is possible to create the illusion of a recoloured object by changing the light, rather than changing the object. The fading of furniture is a complicated matter; in some cases it is decided to recolour an object. In such a case (reversible) changes are made to the object, in other words, to its reflection spectrum. Actual physical recolouring is generally thought to be too invasive, and as a result of this the furniture is exhibited in its faded stage, not showing the intention of the maker, or is left in the depot as it is, considered to be not fit for display. Contrary to existing methods for recolouring faded furniture, the method proposed in this article is non-invasive, reversible and very flexible. By projecting coloured light onto discoloured objects the illusion
of a recoloured object is created. When the light is turned off, the object is shown as it is, in its faded state. Furthermore, if due to new knowledge another colour or hue needs to be projected, one can easily adapt the projected light.

In this article two case studies are presented. First, research was carried out on a buffet that was made between 1933 and 1936 by Piet Kramer (1881-1961) in Amsterdam School style (figure 1). This buffet is part of an ensemble of fifteen pieces of furniture in the collection of the Cultural Heritage Agency of the Netherlands (RCE). A flower marquetry commode, made in 1766 by Andries Bongen, was an even more challenging case (figure 2).

The commode is part of the collection of the Amsterdam Museum. Research on this commode is presented as work in progress, but it shows the potential of the proposed illumination technique. Both objects have in common that they originally were characterised by bright colours, which have faded to different hues of brown. For both pieces of furniture colour is an important element of their design. It can be stated that without their bright colours these pieces of furniture no longer represent the original idea of their makers.

There are multiple ways of using coloured light to create the illusion of a recoloured object. In the field of conservation tests with coloured LED spotlights, lights with colour filters and projection mapping with beamers have been carried out before. In this study it is decided to use projection mapping in combination with beamers. Projection mapping is a projection technology used to turn objects into the display surface for video or image projection. This method is thought to have some clear advantages and has not been tested to recolour faded furniture. Colour can easily be projected and changed when necessary, and multiple colours can be projected simultaneously. Another advantage is that this method can be applied relatively low tech and at low cost.

Research is structured similarly for both case studies. After an introduction visual and technical research was carried out. Based on this a provisional goal for the colours of the piece of furniture was set. The colours of the projected light were then established and mapped on the object. Finally the result is discussed and evaluated.

Case study 1: the Kramer buffet

Where early Amsterdam School furniture is characterised by expressive organic and voluminous decoration this late Amsterdam School buffet is much more sober in design and decoration (figure 1). Originally, the bright monochrome orange colour gave the buffet its expressive appearance. The inside and some parts of the outside of the buffet, which have hardly or not been exposed to light at all, are still brightly coloured, while the rest of the outside has the colour of the oak substrate, with only a slight shade of orange (figures 3, 4).

Through visual analysis three stages of fading of the dyed colour were identified on the buffet: parts that have completely been protected from light, parts that have completely been exposed to light,
Retouching without touching. Creating the illusion of recoloured furniture through light projection

and parts that were often protected from light (figure 5). The oak substrate has darkened a bit over time too. This discolouration did not happen homogeneously, which is visible on, for example, the doors. Strokes of lighter and darker oak can be recognised (figure 1).

Technical analysis

Previous research carried out by the University of Amsterdam (UvA) has focused on three important elements concerning synthetic dyes, applied on Amsterdam School furniture. Firstly, through chemical analysis it was proven that anilin colourants were used to colour Amsterdam School furniture. Based on historical recipes reconstructions were made that showed that these types of dyes were originally characterised by their intense colours. Artificial ageing of the reconstructions by exposure to light and to fluctuations in temperature and relative humidity gave insight into the light-fastness of these dyes. Results proved that most synthetic dyes exposed to light loose colour quickly. After being exposed to five years of museum lighting, the dyes containing, for example, diamond green or methyl violet, had lost all colour. The colour of synthetic dyes also turned out to change without the influence of light, yet much slower.

Previous research on the buffet proved that the discoloured orange dye was original and not the result of re-dyeing. In order to determine the aspired colour to be projected on the buffet samples of the bright (not exposed to light) orange dye were taken and analysed through high pressure liquid chromatography (HPLC). Results showed that the dye is composed of 53.7% tartrazine, 38.5% Orange GG, 5.3% cochenille red A, and 2.5% of a Ponceau type. For our understanding reconstructions were made in which this same proportion of colourants was used. A concentration of 15 gram per liter created a similar orange colour as visible on the inside of the buffet. Two important side notes need to be made. Because some synthetic colourants discoulour quicker than others, the original proportion (and colour) might differ from the measured proportion. It is also important to state that the measured proportion of synthetic colourants does not give insight into actual concentration of colourants applied in the dye. It has so far turned out to be impossible to establish the concentration of colourants through documentation. This means that some uncertainty about the original colour remains.

Provisional goal

In order to study the potential of the method tested in this article a choice for an aspired colour needed to be made, but is is good to realise that this colour can be adapted afterwards. The colour on the inside of the buffet turned out to be the closest reference point (figure 6). The inside of the door is selected because the substrate is oak, just like the outside of the buffet, and it provides a nice homogenous and larger surface.

Originally, the buffet was dyed in a homogenous orange colour. In the text above it states that different shades of orange could be identified, as a result
of parts being exposed to partial or complete light or shade (figure 5). This heterogeneous discolouration will be recoloured through light projection to a homogenous result. The different shades in the oak substrate will not be corrected as they add to the patina.

Setup, materials, software
In this study we decided to use projection mapping software with beamers. Two relatively new, standard Epson EB-S9 presentation beamers from the UvA were available for use. It was decided to use one beamer per side; one beamer for the front of the buffet and one for the proper right side. The buffet is placed sideways in front of a white wall. This way the front side and the proper right side were clearly visible. In order to avoid disturbing reflection of all the light the beamers were placed under an angle at 2.10 meter height 3.9 meters away from the buffet. The room in which the buffet was placed was relatively dark; lights were turned off and only a little natural light (measured at a light intensity of about 30 lux) entered the room. Video Projection Tools 7 (VPT7), a free downloadable projection mapping program, was selected and installed on two laptops, which each controlled a beamer. The program is originally designed for use in the music industry. VPT7 is very user-friendly: shapes can be made and colour, expressed in RGB-values, can be assigned to these shapes. VPT7 has of course more functions but not all of these were necessary to use.
Method

Three experiments were used to develop a method which was then applied onto the buffet. Because our perception is influenced by both the reflection spectrum of the object and the spectrum of the light the following statement can be made: the perception of the bright orange reference colour illuminated with white light should be identical to the discoloured outside of the buffet illuminated with coloured light. In order to determine the colour of the coloured light it was necessary to quantify the discoloration first. These measurements were used to calculate the colour of the coloured light. Next, shapes were made in VPT7 that masked the discoloured outside of the buffet. Lastly, the calculated values of the coloured light were assigned to the precisely fitted mask. The same white light that was used during colour measurements was then used to illuminate the background and the reference colour. In the following text these steps are set out in dept.

Colour measurements

While colour measurements in the field of conservation are often measured with a spectrometer, it was decided to use a digital photograph to do the colour measurements. A spectrometer consists of an internal light source that is different than the white light with which the reference colour and background were illuminated when discoloured parts were to be recoloured. In order to get information on the relative colour difference the whole buffet was illuminated with light with a RGB value of 0.75 on a arithmetic scale of 1. This white light was thought to be of a pleasant intensity and hue. A picture was used to do digital colour measurements on with the DigitalColor Meter Program from Apple (figure 6). The DigitalColor Meter program was set to measure the average colour of four pixels. Twenty measurements, expressed in arithmetic RGB values, were carried out on the inside of the right door. Because the oak of the outside of the buffet was less homogenous than the inside of the door, fifty measurements were taken to average the colour of the discoloured outside. In histograms 1-3 the measured R-, G-, and B-values are set out. Each bar represents ten measurements. For both the reference colour and the discoloured colour an average, a highest, and a lowest RGB value were determined.

Calculating the colour of the coloured light

It is previously stated that our perception of colour is both influenced by the spectrum of the light and the reflection spectrum of the object. Therefore the following equation can be drawn up:

Perception = RGB value light x RGB value object.

Because the goal is to make the perception of discoloured parts of the buffet equal to the reference colour it can be stated that:

Perception = RGB value white light x RGB value reference colour = RGB value coloured light x RGB value discoloured parts of the buffet.

The RGB values of the white light, set through VPT7, are known, as well as, after carrying out colour measurements, the reference colour and the discoloured parts of the buffet. Therefore, with
By carrying out the calculations with both the average, the highest, and the lowest measured RGB values a range for the RGB value of the coloured light is determined.\[^{10}\]

\[
\begin{align*}
R\text{-range} & = 0.72 - 0.87 \\
G\text{-range} & = 0.20 - 0.50 \\
B\text{-range} & = 0.67 - 0.83
\end{align*}
\]

**Projection mapping on the buffet**

Using the projection mapping software program was quite straightforward. Masks were created in VPT7 and projected by the beamers. When the beamer was focused well, a slight grid pattern made up of the pixels, typical for beamers, was visible from up close. By setting the beamer slightly out of focus this pattern was no longer visible at all. The shapes were fine-tuned during projection, so that they precisely covered the discoloured outside. The background and the reference colour stayed illuminated with the same RGB value of 0.75, which was also used during colour measurements. Within the calculated range, a RGB value of 0.87, 0.45 and 0.6, which is a pinkish colour, created a good match with the reference colour, illuminated with white light (figures 7, 8). While the range is quite large, it was experienced as a helpful tool as a good colour match was selected quickly. While variations in the colour of the oak were not corrected, the difference in the colours on the left side of the buffet, which was the result of partial shading from light, was corrected by projecting a slightly different RGB value (figures 9, 10).

**Result and evaluation**

The result was evaluated through measurements and qualitative perception research. Digital colour measurements were carried out on a picture that was taken of the achieved result (figure 8). Ten measurement on both the reference colour, illuminated with white light, and the discoloured parts, illuminated with coloured light, were carried out. The average RGB value of 131.9, 29.8 and 20.9 of the reference colour and an average RGB value of 138, 32.8, and 22.4 of the recoloured outside proved that a good colour match was achieved.

Lux measurements were carried out to determine whether the result met guidelines for museum...
lighting. The coloured light has a light intensity of 140 lux, which was found acceptable since the projected light wavelengths don’t contribute to further discolouration.

The result was also evaluated by asking a group of ten conservation scientists, curators and conservators of the RCE and the UvA to answer a questionnaire of seven questions. The questions focused on finding out whether the result was experienced as realistic and whether a difference in colour between the reference colour and recoloured parts and a difference in colour through light or through dyeing was observed. The response was very positive. The result was thought to be highly realistic and patina was kept. The orange colours were found to be identical. Projected light imitates a dye very well as it has the same transparent qualities.

One of the conservators wrote: ‘As a whole it gives a natural and balanced appearance. The difference between the more discoloured and well preserved parts is equalised to a degree that gives a rustig beeld [calm image] whilst preserving local variations that prevent “overkill” and give a natural effect.’

Because the result was found to be very satisfactory more objects from the RCE ensemble were ‘recoloured’ by projecting coloured light as part of a test exhibition at ‘Bijzondere Collecties’ (UvA special collections) in Amsterdam (figures 11-13).

Case study 2: the Bongen commode

The bombé commode by Andries Bongen is decorated with a marquetry design of different flowers in a vase, a little butterfly, tropical wood veneers and gilded mounts. The object has been in the collection of the Amsterdam Museum since 1970. Bongen engraved his name in the marquetry on the frontside of the commode (figure 2). Dutch Rococo furniture makers often did not sign their furniture, which makes Bongen an exception.

The commode has been dated back to 1766 because of an advertisement in the Amsterdamsche Courant of the fourth of December, 1766, that makes mention of two commodes; the commode in the collection of the Amsterdam Museum has been identified as one of them. The advertisement gives clear insight into the fact that the commode originally had a different, coloured appearance. It states: ‘By Bongen. Mr Kastenmaker, op het Spui, tussen de Voor-en Agterburgwal, zyn dagelyks te zien, en voor een redelyke pays te koop, twee Comodes, met gecouleurd Bloemwerk ingelegd; een Secretaire of Schryf Tafel, waar op 4 Kindertjes, veerbeel- dend de Negotie, ingelegd en gegraveerd: zynde deze Stukken naar Fransche wyze gemaakt, en kunden voor Kunstwerk doorgaan.’ [By Bongen. Cabinetmaker, on the Spui, between the Voor-and Agterburgwal, on view daily, and for sale for a fair price, two commodes, inlaid with coloured flower marquetry; a secretaire or writing desk, on which four children, depicting Trade, inlaid and engraved: these objects are made in French style, and could pass for works of art.] This advertisement shows that Bongen priced his own work by the fact that it is decorated with gecouleurd Bloemwerk [coloured flower marquetry]. The commode in its current state is appreciated, but since the original colours are lost it only partially represents Bongen’s original idea. Research on creating the illusion of a recoloured commode is still in progress. It this first test phase we have focused on recolouring the front of the commode through light projection. Mapping and recolouring the monochrome buffet was relatively...
The commode is finished with a transparent finish, which was not further investigated. While most flowers have discoloured to a light brown colour, some still showed a trace of a green colour (figure 15). It is possible that this green colour indicates an original blue colour of which the yellow components have discoloured. The leaves and branches, while also made of holly, have discoloured to a darker shade of brown than the rest of the marquetry. This could be the result of certain ingredients in the dye.

When analysing the marquetry it also became clear that the depicted flowers and leaves were originally engraved and that sand-shading was applied. Engraving and sand-shading marquetry designs was common practice in the eighteenth century, adding depth to the leaves and flowers. This increased, together with the colours, the realism of the depicted image. This realism had become an important element since the 1740s. Due to sanding some of the engraving and almost all of the sand-shading seemed to be lost. The engraving was probably originally filled with a black or coloured paste. Now the engraving that is still visible, yet very shallow, seems to almost have the same colour as the colour of the veneer (figure 15).

Visual analysis
In order to retrieve information on the original colours of the front of the commode, visual and technical analysis was carried out. Through visual analysis the tulipwood and purpleheart veneers were identified. By removing two pieces of the mounts that covered both the purpleheart and tulipwood it became visible that the veneers had lost their initial bright colour, which was to be expected after 250 years (figure 14). As a contrast, between the tulipwood and purpleheart a narrow strip of holly is applied. Holly was also used for the marquetry design. The commode is finished with a transparent finish, which was not further investigated.

While most flowers have discoloured to a light brown colour, some still showed a trace of a green colour (figure 15). It is possible that this green colour indicates an original blue colour of which the yellow components have discoloured. The leaves and branches, while also made of holly, have discoloured to a darker shade of brown than the rest of the marquetry. This could be the result of certain ingredients in the dye.

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Because eighteenth-century marquetry artists aimed for realism, information on the types of flowers that are depicted and their likely colour is of importance to set a provisional goal. With the help of botanist Dr. Sam Segal it was tried to determine the types of flowers depicted. The red roses (Rosa gallica), two types of yellow-orange narcissus (Narcissus tazetta aureus & Narcissus poeticus), red-pinkish papavers (Papaver somniferum) and blue primulas (Primula x pubescens) were quite easily and surely identified. While roses appear in multiple colours in the eighteenth century the most likely colour of these roses is red, as cultivated red roses became en vogue. Other flowers were more complicated to identify and multiple options were opted. For example, one type of flower could be an alpine clematis (Clematis alpina) or a vinca (Vinca major), both of which are a purplish blue. Also the white-yellow anemones (Anemone nemorosa) were not quite surely identified.

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Technical analysis
In the past years, research on unraveling the original coloured appearance of marquetry furniture has been carried out. By studying historical documents and recipes for eighteenth-century natural dyes reconstructions have been made, and our knowledge of the original appearance of marquetry furniture has improved greatly. With this knowledge, combined with chemical analysis of colourants and metal compounds that can still be detected in veneers of marquetry furniture, digital reconstructions of the original appearance of specific pieces of furniture have been made. But similarly to research on synthetic dyes, chemical research, such as HPLC analysis, does not give information on the concentration of natural colourants in dyes. Therefore, some uncertainty remains on the precise colour hue of these dyes applied on marquetry furniture.

Chemical analysis was carried out on the commode to identify colourants and metal compounds, yet no reconstructions, based on historical recipes, with these colourants and inorganic compounds have been made yet. Therefore, technical analysis was used to help support the botanical research that has been carried out. Based on these two elements a provisional goal was set.

Both X-ray fluorescence (XRF) and HPLC have been carried out on the commode. XRF gives insight into inorganic compounds, while HPLC analyses organic elements. For the HPLC analysis it was necessary to scrape some material of the back of veneers. It was decided to aim for a sample of each type of flower, the branches, the vase and the butterfly. Small pieces of veneer were carefully loosened and lifted from the commode. The backsides of these veneers provided interesting information. The backside of a veneer of the rose showed a red colour (figures 16, 17). Samples for HPLC analysis were scraped of the backsides of the veneers under a microscope. The veneers were then glued back with hide glue.

XRF analysis was carried out with a portable Bruker Tracer III. Measurements were done directly on the commode, rather than on the removed pieces of veneer. It has so far proven to be difficult to filter relevant information from the results.

Provisional goal
Based on both the botanical knowledge and chemical knowledge of the colourants a provisional goal was set (figure 18). It needs to be stated that this goal should be seen as an educated guess - no further research on determining and reconstructing dye recipes has been carried out yet. In this stage it was found important to find out if it was possible to recolour the commode (with all its fine details) convincingly by projecting coloured light. Reconstructions of the dyes will be made in a later stage, the projected light colour can easily be altered accordingly.

Setup
In order to recolour the commode with coloured light the commode was placed in front of a white wall in an exhibition room at the Amsterdam Museum. The room was illuminated with a light intensity of 30 lux and no spotlights were aimed directly at the commode. At a height of 10 centimeters from the floor one standard presentation beamer was pointed at an angle toward the front of the commode. The backside of a veneer of the rose showed a red colour (figures 16, 17). Samples for HPLC analysis were scraped of the backsides of the veneers under a microscope. The veneers were then glued back with hide glue.

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the commode. The beamer, that was made available by the museum, has a short throw ratio of 0.52:1, which means that at a short distance of 52 centimeters from the commode a projection screen with a width of 100 centimeters is created. Because the beamer has a native resolution of 1280x800 and small details on the commode needed to be mapped out correctly, it was found important to use the resolution optimally. At a distance of about 80 centimeters away from the commode the whole front of the commode and a little of its surrounding background was covered by the projection screen. The beamer was fastened on a specially made pedestal, because any movement means realignment of the mapped image. The beamer was connected to a laptop whilst installing and fine-tuning the projection of the image.

Method and mapping

In case study 1 colour measurements and calculations formed the foundation for the RGB colour value of the projected light. In order to do these measurements and calculations the reference colour and the discoloured surface needed to be illuminated by the same light and then photographed. Because there are no reconstructions, in other words, no concrete reference points, made for the dyes on the commode it has not yet been possible to perform colour measurements and make calculations. This means that the projected RGB values are decided solely through visual analysis with the provisional goal in mind.

Projecting colours precisely onto the commode was complicated compared to mapping the buffet. Multiple colours needed to be projected precisely to create the illusion of a recoloured front. Some branches are only three millimetres in width. Projecting a non-warped, 2D recoloured image of the commode would not give a good fit due to the bombé shape of the front of the commode. The projection of a grid clearly shows the deformation that occurs (figure 19). The recoloured image needed to be warped.

It was decided to use a 3D scan of the front of the commode as the base for warping the projected image. This scan was made by Sander Mettes through photogrammetry with Agisoft Photoscan. It provided a very high texture resolution, which means that fine details, such as the grain of the wood, were visible on the scan (figures 20, 21). In the texture of the scan masks for each group of flowers, the branches and leaves, the vase, the butterfly, the purpleheart, tulipwood, the strip of holly, but also the mounts were made. The masks were then rendered in 3Ds Max. In figure 22 the mask for the branches and leaves is shown.

Figure 19 The projection of a grid onto the front of the commode demonstrates the distortion that occurs.

Figure 20 The making of a 3D scan of the front of the commode through photogrammetry with Agisoft Photoscan. Photo: Sander Mettes.
Retouching without touching. Creating the illusion of recoloured furniture through light projection.

High texture 3D scan the slight difference in colours, still visible in the tulipwood, was highlighted. This was used to create a mask in which the typical straw-coloured background and pink streaks were added. Together all these masks formed the projected image. In Photoshop each mask can easily be assigned any RGB value.

In the rendered image a low viewpoint, imitating the viewpoint of the beamer, was picked (figure 23). By using Resolume Arena 5 Media Server, a software program with projection mapping functions, the distortion of the image was fine-tuned (figure 24). VPT7 was not used because warping could only be done to a limited standard and did
not provide a sufficient result. Once the masks were projected and tested separately, the coloured image was projected (figure 25). Once the image fitted well the light intensity was lowered slightly to achieve a realistic result and acceptable light intensity levels (figures 26, 27, video 1).

In order to exhibit the projected commode at the Amsterdam Museum a loop of three files (a blank white page, the warped coloured image, and a no light page) was created. In this loop the recoloured image was set to show 30 seconds, while the other two slides showed 10 seconds. This loop was then placed on a SD card and put in a Brightsign 4810-13 to control the beamer.

**Results and evaluation**

The result is evaluated through visual analysis and through light intensity measurements. In this stage no qualitative perception research was carried out. The main focus was put on determining whether the projected image fitted well, and whether the result looked realistic.

Despite the limited resolution of the beamer the image fitted well, and details were masked precisely. Slight impreciseness can be detected from up close, but overall the steps that were taken resulted in a sufficient fit (figure 27). A slight displacement of the commode that happened when we were not testing caused an impreciseness in the projection, which highlighted the sensitivity of the setup. It turned out that the upper drawer had moved a little bit.

Setting the beamer slightly out of focus in case study 1 prevented the grid pattern that was caused by the pixels which made up the projected image and that was visible from up close. But since the multi-coloured projected image needed to be projected exactly onto the commode, setting the beamer slightly out of focus gave an imprecise result.
Therefore the beamer had to be in focus, which creates a grid pattern that is slightly visible from up close. At a viewing distance of about 1.5 meters this grid pattern does not distract from the result. As explained before, the beamer was placed in front of the commode on the floor at a distance of about 80 centimeters. In this setup, due to the projection angle, all projected light is reflected straight to the eyes of the viewer. From certain viewing positions the result is less realistic than others. For example, a reflection of purple light could be visible when projecting purple on the purpleheart (figure 28). A better setup will correct this problem; we expect that attaching the beamer to the ceiling could correct this problem.

In the first case study it was found that the projected light imitated the qualities of a dye well; in case study 2 this was also the case. In this stage of the experiment the realism of the result was important; it was kept in mind that the set RGB values could be changed easily. As for the purpleheart and tulipwood the aspired result was known. The projected coloured light yielded a realistic result: the illusion of fresh purpleheart and tulipwood was convincingly created. The wood grain remained visible, which added to the realism of the result. The projection of streaks of pink and a straw-coloured background created a good result onto the discoloured tulipwood.

The colours projected onto the vase, the butterfly, and the gilded mounts need to be improved. The mounts were lit with a slightly greyish cold colour of white light to create a more calming result. This was a wrong choice because the colour of the mounts partly lost its warm gold appearance. This can easily be improved by changing the colour of this light from cold white to warm white. More research is necessary to improve the colour of the butterfly and the vase.

In this stage it is difficult to evaluate the accuracy of the projected colours of the branches, leaves and flowers, but the result does provide useful information. It is clear that the illusion of bright colours can be achieved. Creating a strong illusion of white-yellowish flowers caused difficulty because the surface is light brown. The flowers are still a little light yellow-brownish. We succeeded in creating the blue, green, red and pink colours. Colour contrast was sufficient but could be improved. By dimming the beamer its colour output and light intensity decreased. A larger colour output could be reached by the beamer when the projected light is not, or less, dimmed, but this would also increase the light intensity, which could make the result look less realistic. More research is necessary to achieve an optimal balance.

Lastly, after creating the illusion of a recoloured marquetry design the flowers and leaves were experienced as very two dimensional. The loss of sand-shading and engraving became clearly visible, more so than when the commode was not recoloured. It would be interesting to investigate whether it is possible to reconstruct this through projection mapping.

Aside from a visual evaluation, lux measurements were carried out in order to judge whether the projected light met guidelines for museum lighting. The white light that was used for illuminating the background was measured at 140 lux. The purpleheart was illuminated at 45 lux, the leaves and the branches at 55 lux. The overall light intensity was found acceptable.

It can be concluded that recolouring the discoloured commode through light projection has proven to be a promising method. Different colours can be reached and fine details can be mapped correctly onto bombé shapes. A realistic result was achieved and light imitated the qualities of fresh tropical woods and dyes well as the grain of the wood stays visible.

Conclusion

Results have shown that light provides a good and promising alternative for recolouring faded pieces of furniture in museum settings. A method with a series of steps has been developed, from doing colour measurements, colour calculations, visual and technical research, making a 3D scan and using projection mapping software. Recolouring the monochrome buffet has shown to be straightforward. The result was found to be highly realistic and lux levels were acceptable. Where a physical restoration is not considered an option, but a more accurate representation of the original appearance is aspired, light can provide a useful solution. Recolouring the bombé commode has proven to be more complicated, but the results so far are promising. Further research is necessary to improve the accuracy and realism of the result.

Further research

Further research will focus on two aspects: researching and making reconstructions, and optimising the technical setup. By making reconstructions of the dyes a better and more accurate (provisional) goal can be set. With these reconstructions colour measurements can be carried out to calculate
a range for the RGB values of the various masks. When fine-tuning the colour of the projected light it would also be interesting to investigate whether it is possible to reconstruct and project the lost engravings and sand-shading. It will be challenging to actually project such detailed lines and to set a goal for the engraving and sand-shading. A reconstruction of the engraving and the sand-shading might be done based on the remaining engraving and sand-shading on the commode and on other pieces of furniture by Bongen.

In both case studies standard beamers have been used. In case study 1 a good result was achieved with these beamers. In case study 2 a standard beamer provided a sufficient resolution and colour range, yet both could be improved. In this study a small budget was available, so using the standard beamers was a good choice. It would be interesting to find out whether a better overall result can be achieved with a high-quality beamer. Also, being able to use more beamers would make it possible to recolour all sides of both objects. Generally, more expensive beamers provide a higher resolution and larger colour range in combination with a higher light intensity. When imitating the qualities of a dye a high light intensity could result in a less realistic result. Also, the guidelines for museum lighting might not be met. While it is possible to dim the light intensity this also means that the colour output becomes smaller. In other words, less light means a smaller colour range. Through tests it could be determined whether it is possible to reach a balance between these elements with a high-quality beamer.

Creating the illusion of certain colours depends on the colour that is aimed for, the colour output of the beamers, but also on the colour of the substrate. The bright colours of both the buffet and commode have faded to light brown, which makes it relatively easy to recreate the illusion of bright colours again. But there is a point where the colour of the substrate is too dark for realising a light and bright colour. Creating tests in which the colour of the substrate differs, could help determine the limitations of this technology. We hope to continue this research in 2018.

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Notes
1 Vienot, F., e.a., ‘Leds as a tool to enhance faded colours of museum artefacts’. In: Journal of Cultural Heritage, volume 12 issue 4, 2011.
6 Timmer, 2015, p. 12.
Retouching without touching. Creating the illusion of recoloured furniture through light projection

10 F. Ligterink, conservation scientist at the RCE, helped drawing up these equations.
13 In 2015, we exhibited a nightstand and a chair for four months at the special collections department of the University of Amsterdam. Museum visitors could fill in a short questionnaire. Most people experienced the result as realistic.
16 Baarsen 1988, p. 27.
17 Baarsen 1988, p. 28.
18 Dr. S. Segal is a botanist specialised in identifying flowers in seventeenth-century and eighteenth-century still lives.
21 XRF analysis was carried out by Han Neevel, conservation scientist at the RCE.
22 A Vivitek D857 450080-05 projector was used.
23 Sander Mettes works for Cre8 and specialises in 3D scanning and printing. Sander provided a rendered 3D scan of the front of the commode.
Dutch painted furniture. Imitation of function, style, construction and material

Hans Piena

Research
The last fourteen years I have conducted research on Dutch painted furniture and its makers. The research included a survey of all known painted pieces in Dutch museum collections. Apart from that, the archives of the major production centres, such as Amsterdam and Rotterdam, have been studied extensively. Although oak examples do exist, the vast majority of Dutch painted furniture is made of softwood. These pieces were produced in cities by members of guilds known as witwerkers. ‘Wit’ means white, and at that time it referred to the unpainted state in which the masterpiece had to be presented, as well as to the pale colour of the softwood.

Guilds
Witwerkers emerge in the biggest cities first. Their rise correlates with the size of the city, which also allowed specialisation of craftsmen. The larger the cities the more room for specialists like witwerkers. The first witwerkers guild was founded in Amsterdam in the early seventeenth century. During the course of the seventeenth century, other cities in the most densely populated region followed, such as Dordrecht and Rotterdam. Later, during the eighteenth century, guilds were established throughout the whole northwest of the Netherlands.

Number of witwerkers
At the end of the Golden Age the number of witwerkers grew considerably. Through the influx of immigrants there was a need for more furniture. Because of the stagnating economy from 1660 onwards, this furniture needed to be cheaper and cheaper. With softwood and paint, witwerkers offered the solution. The numbers of witwerkers within these guilds vary from city to city. In small towns like Alkmaar and Middelburg only a few were active at any given time. In Amsterdam, between 1600 and 1800 a total of 576 different witwerkers are known by name. These are primarily the masters; the list do not include the anonymous servants. From the French period (1795-1811) we have lists of both masters and servants. These lists show that the total number of people active in the field was three to four times higher. Within the St. Joseph guild, which headed all woodworkers, the witwerkers formed the third biggest group, behind the carpenters and cabinetmakers. During the eighteenth century more than fifty workshops were active simultaneously in Amsterdam.

Trade
Witwerkers sold their furniture in different ways. First of all, there was the guild shop in which all witwerkers could present their furniture to the public. This shop was run by the wives of the witwerkers. Secondly, there were the market places where individual witwerkers could sell their goods. Thirdly, the furniture was traded by ship all over the country into even the smallest hamlets. And finally, painted furniture was, like anything else, sold secondhand at auctions and on the street by private owners and merchants.

The distribution was not restricted to the Netherlands alone. Witwerkers are known to have exported their products to Germany, Russia and to the former colony of Suriname. Nowadays we still find examples in Norway, Sweden, Denmark, England, the Caribbean and the United States.

Total production
How many pieces of furniture did they make? The account book of one master witwerker has been preserved. His name was Frans Dirksz Sluijter (1667-1727), from Amsterdam. The account book covers a period from 1706 to 1720. During these fourteen years he produced a total of 11,685 pieces of furniture, ranging from all kinds of tables and cabinets to smaller items like tea trays. Sluijter had a large workshop with eight servants. The average workshop at that time had four. Taking this into account the total national production of witwerkers in the early eighteenth century must have amounted to just under 50,000 pieces of furniture each year.

Price
With paint and softwood witwerkers were able to imitate every existing fashionable model, such as cabinets, wardrobes, chest of drawers, tables and...
Dutch painted furniture. Imitation of function, style, construction and material

roll-top desks. Although smaller in number than the cabinetmakers, witwerkers probably produced more items per day. Their simple construction and decoration techniques made this possible. Only when really necessary they used joinery like mortise-and-tenon joints. In order to reduce drying time the paints were often water-based and the varnishes spirit-based. Not only could they produce items more quickly, witwerkers could also produce at lower cost, because of their simple techniques and cheap material. During the eighteenth century a witwerkers cabinet cost on average about a quarter of the price compared to the cabinetmaker’s equivalent.

Role in society
It is long believed that painted furniture was a rural phenomenon, and a late echo of city life, a case of gesunkenes Kulturgut, but it is not. Throughout the period of research (1600-1900), witwerker furniture and cabinetmakers furniture was used side by side in the same households in every city and throughout the countryside. For instance, the more representative mahogany gate leg table took pride of place in the living room, while at the same time the mahogany grained gate leg table was used in the kitchen. Just like nowadays we have an upholstered set in the living room and a plastic set in the garden.

Both the cabinetmakers piece and the witwerkers equivalent were contemporary. There are some important exceptions in which witwerker furniture played the leading role. With paint, witwerkers were able to evoke vivid biblical or mythological scenes far better than the cabinetmakers with their veneer. During the eighteenth century tea tables with such scenes were immensely popular in the representative rooms of the aristocracy. In this period one or two beautifully painted pieces were combined with cabinetmakers furniture in the prestigious living rooms. Towards the end of the eighteenth century painted furniture even became a dominant feature in the interiors of the elite. The nobility and aristocracy choose completely painted suites of furniture, including chests of drawers, wicker chairs, gate leg tables, bed tables and canopy beds.

Contrary to the above examples, there are two types of furniture that, during the nineteenth century, do form a late echo of elite furniture, illustrated in the following case study.

Figure 1 Roll-top desk, Carel Breytspraak, 1808. Collection Royal Palace Amsterdam. Inv. nr. KP 4183.
A bureau for the king, groats for the people

In 1808 King Louis Napoleon converted the former town hall at the Dam Square in Amsterdam to a royal palace. For this he ordered hundreds of pieces of furniture. Louis Napoleon more or less imitated the prestigious interior decoration schemes of the palaces of his more powerful brother, Emperor Napoleon Bonaparte. Among the suppliers was Carel Breytspraak, the best paid furniture maker of the king. His most outstanding piece is no doubt the roll-top desk, still in the palace today (figure 1).1 The construction wood is oak, on top of which mahogany veneer is applied in mirrored fashion. For Dutch standards the mercury-gilded fittings are of exceptionally high quality. The roll-top desk must have made a devastating impression on the furniture makers in Amsterdam and from there on reverberated throughout the country, not only among cabinet-makers but also among witwerksters.

The affordable echo

The echo of the roll-top desk is clearly visible in witwerkster furniture. Pieces with different functions began to mimic not only its shape, but also the mahogany and even the mirrored veneer. Apart from that, the witwerkster equivalent was also embellished with fittings. Contrary to their royal counterpart cast iron ornaments were used, originally produced for iron stoves. Needless to say, the gilding is not gold but bronze paint.

Figures 2a, b  Groats chest, 1810-1850. Size: h 127 x w 115 x d 32.5 cm. Collection Holland Open Air Museum. Inv. nr. NOM.11120-50.
Equality and writing

Let us ponder a little longer on the imitation of writing desks. Ever since there have been differences in wealth and power, people have tried to imitate the life of those one step higher up the social ladder. The Napoleonic era added a political dimension to this. The power of the Dutch nobility and aristocracy and their nepotism got restricted. Guided by the principle of equality one was rewarded for his merit, not for his birth. It meant more class mobility. People from lower strata obtained administrative positions. It is all condensed in Napoleon’s own hobbyhorse: ‘Chaque soldat porte un bâton de maréchal dans sa besace’, in other words, everyone has a chance to get promoted. The constitutions from 1798, 1801 and 1805 stated that those men who could support their family, who renounced federalism and who could read and write were allowed to vote. (Women, like slaves, were excluded, equality had its limits.) This way ones social status got linked with literacy. Much of this was turned back once Napoleon was defeated. However, having had a taste of equality, the masses, more than ever before, started to copy the lifestyle of those higher up the social ladder. This in essence is reflected in the popularity of the roll-top desk.

Groat chest

There was only one slight problem in all of this. The king could be expected to need a roll-top desk since he had a lot of writing and reading to do.
The average witwerker's costumer had no need for a roll-top desk since he did not earn his living with reading and writing. Particularly during the hard times after Napoleon the majority could only afford the most basic furniture for storage, eating and sleeping. The roll-top desk lookalikes, once opened, turn out to be not bureaus. In reality they serve to store groats, i.e. cereals and beans. The Dutch term for these pieces is gortlade or groats chest. Groats chests, disguised as a roll-top desk, were first produced around 1800-1820. The earliest examples reflect the neoclassical style of the late eighteenth century. The youngest examples date from around 1860-1880. They were solely used in the province of Noord-Holland. Some fifteen examples are known to have survived to this very day (figures 2a, b).

Peat chest
Another type of furniture that got dressed up like a mahogany-veneered roll-top desk during this period is the peat chest (figures 3a, b). Due to its purpose it was usually placed near the fireplace. Contrary to the groats chest the peat chest was used throughout the Netherlands. Both the groats chest and the peat chest were produced during a 75-year timespan between 1800 and 1875. They were in use by people of average wealth and of all trades. Apart from the roll-top desk, the shape of a fall-front desk was as popular for groats chests as it was for peat chests.

The ironic thing is: the post Napoleonic elite, so those whose lifestyle served as an example for the less wealthy, did not even write at a roll-top desk. Again and again you see that mayors, notaries, doctors, pastors and teachers worked at a flat four-legged table, covered with green fabric. Clearly the factual use of the roll-top desk was subservient to its appearance when it came to imitation by a lower class.

Conclusion
Dutch painted furniture is mainly produced in cities. It was an integral part of domestic culture both in the cities as well as on the countryside. It is safe to say that every household owned a piece of witwerkers furniture, much like Ikea furniture nowadays. Its popularity can be explained not only by its low price. What is good for king Louis Napoleon is good for everybody. It is in our nature to imitate the material culture and thereby the life of wealthier and more powerful people, each within his own means.

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Notes
Where high art and folk art meet – how rural pieces of furniture depict the differences. Techniques, tools and textures used in rural workshops to upgrade furniture

Karl-Heinz Wüstner

This paper, presented at the 13th International Symposium on Wood and Furniture Conservation, explores the different functions of furniture, what furniture represented, and how it was decorated. Using examples of courtly, bourgeois and rural furniture from the region known as Hohenlohe-Franconia, it is demonstrated how village joiners imitated different kinds of woods and elaborate designs like inlay and marquetry with the use of colour only.

Different functions of furniture in society

For more than a thousand years, furniture in the cultures of Europe has fulfilled several functions. In all social classes, it served first of all as the storage of objects of daily use, of clothing, or in churches and monasteries of the keeping of ritual equipment and instruments. Another important purpose derived from eating and sleeping habits. The shape and size of the furniture were first of all determined by their practicability and usefulness. In different walks of life, however, other functions soon emerged.¹ Accordingly, furniture was used to demonstrate the wealth or social status of its owner, to document claims of power, and therefore, it also served representative purposes. A third aspect emerged mainly in modern society. It is the convenience and comfort that furniture can support and also express visually. Such furniture is more about issues of physical well-being, rest and relaxation. This aspect mainly affects seating and lounge furniture. As a result of this we can easily understand that for a long time the aspirations of nobility and aristocracy and the rather barren and labour-driven environment of the rural population have formed two opposing poles of living quality, furnishings and furniture.

Social prestige played a much greater role in the upper social classes, the clergy, the nobles and the prestigious bourgeoisie in the cities than for the craftsmen and peasants in the countryside. Furniture served to convey their status to others.

The decorative and representative role of furniture

Such a representative role of furniture was not only achieved by its prominent size, but also through eye-catching decoration and through prominent features in the display of its front side. The representative function finds its expression in the use of decorative elements with artistic aspirations. Therefore, it may also be said that there is an additional decorative requirement which must be considered alongside the representative one. Ornamentation and colours were used as a possibility to beautify a room. Thus decor was a decisive factor. Hence, at different times and in different countries and regions, the decor expressed itself in time-specific and country-specific forms.

Influencing factors on the embellishment of furniture

The decor of noble furniture was always influenced by the current trends in art history. Elements of painting, graphics and architecture have found their various ways into the arts and crafts and also into the furniture design practiced by well-trained artisans at court and in the cities.

The decoration of rural furniture with ornamental elements reflects different backgrounds. It originated first from the heritage of mystical and religious symbolism, which was based on signs of salvation and defence. Some of the elements go far back into history, even into times before Christian beliefs, when people practised natural religions. These ancient people already used simple, geometrical, but very symbolical signs that in their understanding had a close relation to nature or were used to keep away evil (figure 1).² In trying to further embellish and structure the surface, a more complex but nevertheless still popular decoration of furniture developed over time. Their creators made use of simple geometrical shapes.

Figure 1 Bride’s chest, St. Florian, 17th /18th century, taken from F.C. Lipp, Oberösterreichische Bauernmöbel, p. 25. Courtesy of Oberösterreichische Landesmuseen Linz.
with circles, triangles as well as heart- and star-shaped forms. In addition, animals and human figures entered the design. The patterns shown here certainly have their roots in folk art. These early pieces of painted furniture were usually chests and their colour was rather reserved.

Since the middle of the eighteenth century, the decor of rural furniture has principally changed. Under the influence of the Enlightenment and with the rising self-awareness of the peasantry, an increasing desire for representation arose. Therefore, more and more elaborate furniture with ornamental and floral patterns also developed in the countryside (figure 2). In these cases the representative and also decorative character of the furniture’s appearance was achieved by a flamboyant use of colour. In the course of the described social change more elements of high art found their way into rural furniture. They were adopted by local craftsmen who tried to offer their customers contemporary designs. That is, the surface design of furniture intended for the peasantry, was taken over by the village carpenters from existing models as were customary in the castles of nobles and in the bourgeois town houses.

But in the case of rural painted furniture it is not possible to exclusively refer to the imitation of materials. We certainly have to consider that pieces of furniture used by the upper classes were not the only models that were imitated in their form and in their decoration. In the same way a corresponding decoration was also on show as architectural elements on the fronts of city buildings, in churches or at the nearest castle (figures 3a, b, c, d). There the ornamentations could be seen as the work of plasterers and gilders, as woodcarving on doors, as the work of smiths at forged gates and fences and as the work of stone masons. Such artisan work displayed a rich number of motifs as elements of decoration. They could be found in many different forms and from all their diversity, the rural craftsmen also drew their inspirations.
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It was easy for them to copy a few ornaments into their sketch book and take them home into their workshop. However, they were probably not aware that the classical, academic art forms had been developed a long time before in the centres of art and architecture common to Italy and France. From these locations it took them many years to find their way into rural areas. Therefore, these ornamentations were not as modern as people thought. Regardless, the joiners met the tastes of their customers. In each single case it was a matter for the individual craftsman as to which ornaments he chose and in what way and arrangement he used them to decorate his products. Additionally, we have to bear in mind that journeymen came into the workshops and brought in new ideas from other regions, or even from foreign countries. The extent of ornamentation would depend on the prosperity of the peasantry or the country people. If they were prosperous they could express their wealth and status in purchasing more magnificently painted pieces than someone who could not afford some well painted furniture.

The role of denomination in furniture embellishment

Another influencing issue on the embellishment of painted furniture is related to religious beliefs. There are two major confessions in Germany: Catholic and Protestant. Especially in times of the Baroque period, catholic churches displayed some exuberant ornamentation in form and colour. The lavish decoration, much of it accomplished as stucco or woodwork, was usually gold-plated as well as colourfully painted. The paint work was often done by professional painters who were employed by the territorial sovereign, such as an archbishop or a catholic prince, earl or count. Monasteries were also centres of craftsmanship where many craftsmen were educated. The craftspeople that had been trained in painting were additionally engaged by local joiners to ornament their most representative pieces of furniture with common elements of high art decoration. It was mostly southern Bavaria and other catholic regions lying south of the river Danube where the joiners, in cooperation with trained painters, created the most outstanding pieces of painted furniture in Germany.

In other areas, mostly in protestant ones, furniture would appear less spectacular if not comparatively unemotional. Protestants kept more to pietism that accentuated spiritual tendencies from which no excessive adornment should distract. Therefore, in protestant areas, a simpler and more modest decoration was executed in churches and as a result also in private homes. Furniture of this type was produced in Wurttemberg, Hesse, Thuringia, Saxony and parts of Lower Saxony. Its decor was generally accomplished by the joiners themselves.

In northern Germany, the production and use of painted furniture was less common. There, the joiners could process more hardwood which was regarded more valuable than the softwood that was primarily available in southern Germany. In view of this aspect we find more carved decoration on furniture in the rural areas of northern Germany and more painted furniture in the farming regions of southern Germany.

Hohenlohe-Franconia is well-known for its diversity of painted furniture

In the following I refer particularly to pieces of

Figure 3c  Wrought-iron gate at the entrance of Ludwigsburg Castle.

Figure 3d  Baroque ornamentation above the entrance of a bourgeois house in Schwäbisch Hall.
furniture originating from a very small agricultural region in southern Germany, called Hohenlohe-Franconia. The name Hohenlohe derives from the family name of a dynasty of dukes and princes who had been the sovereign rulers in the area for many centuries. The term ‘Franconia’ comes from a Germanic tribe and later from a duchy of the same name that once occupied the region. The district itself is located in the very northeastern corner of Baden-Württemberg, overlapping the border into Bavaria. Hohenlohe-Franconia is famous for its large variety of painted furniture that was produced for about 200 years between ca. 1650 and 1850. Despite the fact that the sovereigns and the population have mostly been protestant over the centuries, a rich diversity of very colourfully painted pieces of furniture can be found in this area. This circumstance is due to several reasons that are very special for Hohenlohe-Franconia. To begin with, until the year 1806 there was a considerable fragmentation of the area into innumerable small territories such as bishoprics, margravates, principalities and free imperial cities. All had their local ruler and they lay close together. In addition to the geographical location we must also consider the connections between noble craftsmen who were working in the castles and the ordinary joiners who produced their furniture in the adjacent surroundings. There was sometimes even a direct way from the furniture of nobility to the one of peasantry.

How the design and ornamentation of high-end furniture could find its way to rural joiners

Two examples from Langenburg Castle and the surrounding area demonstrate such a relationship. In the first half of the eighteenth century a carpenter at court named Johann Heinrich Vogt was also designated as guild master. He was responsible for the administrative implementation of the guild’s rules. He organised meetings and conducted the examinations of the prospective masters. In both cases the joiners of the small residential town as well as those of the surrounding countryside were ordered to come to the workshop of the guild master in the castle. There they could have a look around and also see what kind of furniture was produced and what ornamental accoutrements were implemented at court. Although the princes in the Hohenlohe castles were mainly protestant, they tended to favour extravagant and most representative pieces of furniture. In this way a direct transfer of high-class knowledge, art forms and skills took place from the courtly cabinetmaker to the village carpenter.

In the last quarter of the eighteenth century the Prince of Langenburg employed a carpenter at his court whose name was Johann Adam Peter Hirsch. He was born in Bächlingen, a small village lying in the valley right beneath the prominent castle and only twenty minutes away on foot. In that village and at the same time the rural joiner was Johann Heinrich Michael Hirsch, a brother of the one described before. In these cases, we can easily understand how a constant exchange took place between the artisans employed at court and the joiners in the residential town, and in the surrounding countryside. Furthermore, since the middle of the eighteenth
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century the rural population had gained more and more self-awareness. The acquired self-esteem and pride was correspondingly expressed in a trend to more representative and colourfully painted wardrobes and chests. This circumstance played a major role, when a farmer’s daughter married and her rich dowry, including some brightly coloured furniture, was transported on a horse-drawn wagon to her groom’s village under the admiring and recognising glances of the local people. 12

As more precisely painted furniture was in vogue, the prince of Öhringen implemented measures to promote the craftsmanship. Twice a week he opened the doors of a painting school he had founded in 1779 for the education of high school pupils to craftsmen. There they were trained by the prince’s artist and by his architect. More than forty percent of the artisans who attended the school were carpenters who were there to learn how to paint.13

In the following paragraphs some design features and decorative elements of pieces of furniture used by the aristocracy as well as by the growing bourgeoisie are described. The influences of high art on the design and the outer appearance of rural pieces of furniture are apparent.

Copies of the outer appearance

The following examples enable the imitation products of the simple cabinetmakers in the countryside to be compared with the high-quality designs of their courtly counterparts which they imitated on their village furniture by just using colour.

In Weikersheim Castle there are two pieces of furni-

ture which we call Tresur in southern Germany and which is probably the equivalent of the English dresser (figures 4a, b, c, d). The same type of furniture could also be found in bigger cities: made of hardwood, and in the countryside as painted furnish-

made of softwood. The design of the furniture of the nobility was copied by the city carpenters and also by the carpenters in the countryside.

The imitation of popular motifs

From the basic form I now turn to some motifs that found their way from aristocratic furniture down to rural painted furniture. The following examples illustrate the relationship between furnishings in a castle, in a bourgeois household and in a village home. In these cases it is not so much the distinctive form of the furniture but more the outer appearance in terms of the use of different woods and the ornamentation with star-shaped forms (figures 5a, b, c).

The elegant courtly Baroque cabinet shows a pattern made from different dark and light woods. On its centre piece this pattern forms a figure that looks like a sparkling star. The bourgeois cabinet follows this idea and presents two stars as inlay work on its two doors. To accentuate the areas of light wood the cabinetmaker surrounded them with darker wooden panels in the form of a bastion. On the rural wardrobe the precious woods, the inlay work in form of a star, the form of a bastion and the grain were imitated by the use of colour and with the help of different brushes.

The pictured side of a courtly chest of drawers again presents some splendid inlay work. Among flow-
Left:
Figure 5a Courtly Hohenlohe cabinet, 18th century, privately owned.
Figure 5b Bourgeois armoire, end of 17th century, Sandelsches Museum Kirchberg/Jagst. Courtesy of Museums- und Kulturverein Kirchberg/Jagst.
Figure 5c Rural wardrobe made by joiner Johann Heinrich Michael Hirsch (1735-1796) in Bächlingen, dated 1769. Courtesy of Kirchengemeinde Langenburg-Bächlingen.

Below:
Figure 6a Side panel of a courtly Hohenlohe chest of drawers, around 1700, privately owned.
Figure 6b Upper part of a courtly escritoire, Kirchheim unter Teck ca.1720/1730, Landesmuseum Württemberg, Stuttgart. Photo: Peter Frankenstein/Jörg Jordan.
ers and a bird we can recognise some strapwork as a decoration on its surface. The impression is achieved by the masterly use of different dark and light sorts of valuable woods (figures 6a, b).

Another example is an escritoire with impressive inlays. Its main motifs are again exotic birds with a large parrot as a centre piece. Exotic birds were one of the most favourite motifs in the Baroque and Rococo eras. These birds are also pictured on bourgeois furniture (figure 7).

Here you find the birds in the middle of a wooden panel. While the latter were generally achieved by inlay on courtly furniture, the effect on this wardrobe is attained by the use of brush and paint, as are the rocailles and shellwork.

The example of a simple softwood wardrobe demonstrates how the local carpenters not only were able to copy the courtly designs but also showed some extraordinary skills in painting a bird (figure 8). When looking at these pieces of rural furniture in the Hohenlohe-Franconia area we must bear in mind that it was always the carpenter himself who did both: the woodwork and the painting. At least he painted the decor on the doors. The door of a wardrobe always functioned as a trademark for the carpenter. There he used motifs and patterns that reflected his design programme and had a high value of recognition. Other parts may have been painted by other staff in his workshop.

The imitation of marquetry, inlay work, veneer and grain

The following example of a courtly armoire shows how marquetry was used. The difference between inlay work and marquetry is that various woods of different colours and forms are positioned next to each other, as in a jigsaw puzzle, whereas inlay work is characterised by pieces of wood that are inserted into a specially cut wooden structure (figure 9).

You can clearly see the ornamentation done by putting different stripes of veneer next to each other. Round the doors these pieces of wood have a rectangular shape, whereas at the sides the stripes have a rhomboid form. These, arranged next to each other, give the impression of triangles pointing upwards and downwards. At the right side of the wardrobe a vertical accentuation can be seen.

The same effects were achieved on rural pieces of furniture by painting these triangular forms on the surface and also structuring the sides by imitating some vertical grain with colour (figures 10a, b). For this, the joiner had different tools, such as brushes, iron combs and a roller with a profiled gum-roll.
Figure 10a  Rural wardrobe, Limpurger Berge, joiner not known, dated 1803. Museum Wörner, Fichtenberg.

Figure 10b  Detail of wardrobe in figure 10a.

Figure 11  Bourgeois armoire, surroundings of Feuchtwangen, first half of 18th century. Photo: Auktionshaus Eppli, Stuttgart.

Figure 12  Rural wardrobe, surroundings of Feuchtwangen, dated 1778. Privately owned.

Figure 13  Rural wardrobe, surroundings of Crailsheim, end of 18th century. Privately owned.

Figure 14  Elm burl saw veneer. Courtesy of Immel Restaurierung, Ilshofen.
mounted on its front that he moved to create the way he wanted the texture to look.

Some of the previously shown pieces of furniture bear wooden panels in the form of a bastion, some of these displaying a shape with pointed ends. Such panels are a prominent feature in the centre of the doors. In this bourgeois example of an armoire the panels are surrounded by carved mouldings (figure 11). Above and below the centre panels we see an acanthus ornament and the sides of the two doors are accentuated by twisted columns.

In its rural counterpart, a wardrobe of 1778, we can find all these features too. There are the wooden panels in the shape of a bastion, there are turned columns and there is the leafage ornament on the top and at the bottom of the doors. This decoration is a reminder of inlay work with dark wood (figure 12). Other parts painted in white colour possibly imitate white bone inlay. Additionally we find some exceptional imitation of veneer, replicating the curved manifestation of heartwood and sapwood.

The imitation of different types of wood and their textures

The following example shows these characteristics again. Here the doors are encircled by the imitation of small pieces of light and dark veneer. Each door has two cassettes mimicking pieces of veneer cut out from some wood with a nice heartwood and softwood pattern (figure 13). These pieces are arranged inversely in the manner of a cross joint. The rest of the doors and also other brown parts of the surface show the imitation of hardwood veneer. The black lines mimic ebony inlay. Other veneers made from domestic woods like cherry tree, walnut, Hungarian ash, birch tree and even yew tree were also popular for furnishing the furniture of the upper social classes as all of them produced fine, good-looking veneer that demonstrated not only quality but also expert craftsmanship. Especially the root wood of some of these species had a specific look (figure 14). We notice clusters of curved or even round forms and it was exactly these round forms that also inspired rural carpenters to try to imitate them. You can see one of the more modest results in the brown fields of this chest from the year 1784 (figure 15).

Here the carpenter achieved the special ornamentation by first painting a light colour into the fields and on that a darker brown colour. While the second layer of paint was still wet he took a piece of cloth or a natural sponge, turned it in circles and so partly took away the dark brown colour leaving these circle-like shapes.

A chest of drawers shows a surface made from walnut root wood. Its specific vibrant veneer gives a very elaborate and ornate look to this piece of bourgeois furniture as can be seen at the front of a drawer.
er. Of course, it also impressed the carpenters in the countryside (figures 16a, b). They took over the idea and covered the fronts of their rural wardrobes with the same vivid pattern. The wardrobes look even more colourful with this particular decoration, carried out in green or blue colours. The imitation decor was achieved by rolling a crumpled and colour-soaked piece of cloth over a surface that had been prepared with a white ground. Improvements were then done by using some special brushes.

Conclusion

From examples of Hohenlohe-Franconia furniture we have seen how the relationship between the court carpenter and village joiner developed over time. The latter imitated courtly forms and designs and used simple techniques utilising colour and brush to mimic the sophisticated inlay and marquetry decorations as well as the hardwood veneer favoured by the aristocracy and the bourgeoisie.

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Notes
5 Ibidem.
10 Handwerkerbuch der Langenburger Bauzunft von 1683-1752, Württembergisches Staatsarchiv Ludwigsburg F 168, Büschel 467.
11 Hohenlohe Zentralarchiv Neuenstein, Langenburg, Regierung II, Büschel 3565.
12 Gebhardt 1982, 10.

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• All photos, if not stated otherwise, were taken by the author.
Introduction

This study will explore the use of ray skin shagreen in the decoration of furniture. The small number of studies exploring the decorative use of ray skin have tended to examine the material together with shark skin (also known as shagreen), focusing on a particular geographic region or era. The focus of this study has been narrowed, instead, according to object type. The paper will begin by charting the global history of ray skin on furniture, before discussing how ray skin could be considered to have been used in imitation of other materials - namely a type of Persian donkey hide and a Japanese decorative lacquer technique - and how it, in turn, has been imitated. Finally, three conservation techniques for recreating missing ray skin denticles will be described.

What is shagreen?

Rays are a type of cartilaginous fish, related to sharks. Their dorso-ventrally flattened bodies allow them to conceal themselves on the ocean floor (figure 1). Rather than the flat scales one might expect a fish to have, their skin is covered with projections known as placoid scales or dermal denticles. The structure of these denticles is very much like vertebrate teeth; there is a central pulpy cavity supplied with blood vessels, surrounded by a layer of dentine. The outermost layer is composed of vitrodentine, a largely inorganic, enamel-like material. Consequently, they are remarkably hard – hard and rough enough that ray skin used to be used as a rasp for woodworking, and continues to be used in Japan to grate wasabi.

Ray skin was traditionally prepared by soaking the skin in warm water for several days, scraping off the flesh, and drying it. The resulting material is stiff but flexible, particularly so when wet. As well as being durable and waterproof, an interesting aesthetic is created by the arrangement of the close-set denticles, which are largest down the centre of the back and gradually diminish in size towards the edges (figure 2).

There are many different species of ray, and it is extremely difficult to identify the species once the skin has been removed and cut up. However, it is likely that most of the European objects described in this paper use skins of species of the Dasyatidae family – commonly known as whiptail stingrays – which live in the tropical waters of the Indo-Pacific. Several different species are known to have been used in Japanese weaponry; it is probable that the same range of species was used on furniture produced in Japan.

Ray or shark?

Both ray and shark skin are referred to as shagreen. In Europe the two materials have often been used in a similar manner to cover the same types of objects.
To complicate matters further, ray skin objects in museum collections and auction catalogues are frequently mislabeled as shark skin and vice versa. Ray and shark skin are easily distinguishable. Ray skin is thicker and has larger, rounder and bonier denticles, compared to the small rhombic denticles of shark skin (figure 3). The scales of the ray are closely set in a more random arrangement. The scales are not obviously directional. Shark scales are arranged in regular rows separated by furrows and point in the direction of the tail.

History of ray skin in furniture

Japanese-Portuguese trade
Ray skin has been used in Asia since at least the thirteenth century, notably in Japanese weaponry – Its grainy and water-resistant surface providing grip to hilts and decoration to scabbards (figure 4) – and Chinese Qing dynasty composite bows (figure 5). However, there is no evidence that it was used in Asia at this time to decorate furniture for their domestic market.

The earliest known examples of furniture decorated with ray skin were in fact produced in Japan, but were made for the European market. These objects were first imported to Europe by Portuguese traders in the late sixteenth century.

At this time the Portuguese were bringing large quantities of lacquerware from Japan to Europe. This early export lacquerware is known as namban, a term meaning Southern barbarian, applied by the Japanese to all foreigners except the Chinese and Koreans. The lacquer workshops tailored their production to meet the demands of western traders. Furnishings were made in shapes that would have been familiar to Europeans and the lacquer decoration was often of inferior quality to objects made for Japanese consumption. A small percentage of these objects incorporated shagreen.6

Furniture decorated with lacquer and shagreen panels in this period included large rectangular coffers with domed lids, probably made to hold clothing and bedding (figure 6), a type of cabinet with a drop front and inset drawers (figure 7),7 and smaller chests with flat hinged lids and a drawer at the base (figure 8).8 On these objects the ray skin was embedded in lacquer (a technique known as same-nuri). Sometimes the denticles were left intact, the skin being attached to the substrate and the lacquer applied on top; more often the skins were soaked in hot water and left to decay so that the denticles could be extracted, cleaned, and sprinkled
Shagreen. The history and conservation of decorative ray skin in furniture

This allowed large areas to be covered with an even pattern, and without seams between the skins. Whether applied as skins or sprinkled denticles, the scales and lacquer were ground and polished to achieve a smooth, uniform surface. The ray skin was not usually dyed, and was often used in combination with mother-of-pearl cut into geometric shapes and gold decoration, painted onto the black lacquer ground. 10

Japanese-Dutch trade

The Dutch – who superseded the Portuguese as the dominant European naval power trading with Japan in the early seventeenth century – also imported furniture decorated with shagreen and lacquer. The Dutch word for ray skin (rochevellen) first appears in the shipping lists of the Dutch East India Company around 1634, when the Dutch resumed large-scale trade with Japan following a five year ban. 11 On December 31, 1635, the Dutch ship Wassenaer brought ninety-four pieces of lacquer furniture from Japan to Batavia, including ‘eight cabinets with side doors in ray skin and lacquerwork throughout’. 12 The same year, a shipment of 416 lacquer objects, including ‘149 cabinets both large and small, clad with ray skin and lacquer ovals’ was sent from Dutch trading post Deshima to Hirado and presumably later on to Europe. 13

Dutch influence saw a tendency towards a reduction in the use of mother-of-pearl and a move away from stylized floral and geometric decoration towards more realistic pictorial scenes, often enclosed in cartouches. 14 The drawer in the base of lidded chests was seen less frequently, twin doors gradually replaced the drop front, and cabinets were often placed on Dutch-manufactured stands. Sometimes cabinets had no decoration other than panels of lacquered ray skin. An example of such a cabinet can be seen in Impey and Jörg (ill. 288). 15 On that object the central dorsal line of larger denticles can be seen running vertically down the centre of each panel, indicating that the shagreen was applied as skin rather than detached sprinkled denticles.

The cabinet on stand shown in figure 9 is typical of the type of drop-front chest with drawers inside imported by the Portuguese. The base was probably specially commissioned to support the chest. It incorporates the turned oak legs of a piece of furniture made in Holland, but has stretchers made from woods local to Japan and must have been lacquered
The denticles have been carefully sorted by size and are larger on the front than the back. The import of shagreen-covered chests seems to have ceased in the 1640s. This could have been as a result of changing fashions, or diminishing profitability for European trading companies due to increased competition from Chinese merchants. The cabinet on stand in figure 10 has been dated to 1700-1705. In this example the panels have been removed from an outmoded chest and incorporated by the Dutch cabinetmaker into something much more European in outline.

Ray skin furniture produced in Europe – seventeenth and eighteenth century

Later in the seventeenth century, ray skin was shipped to Europe as a raw material, where it began to be used by local craftsmen. For some decades in the seventeenth century, ray skins were an important commodity for the Dutch East India Company. Having recognized the value of ray skin in Japan, trading posts were set up in modern Thailand and on India’s Coromandel Coast to procure the skins. Between 1633 and 1663, exports from the Thailand office to Japan included nearly half a million ray skins. The Japanese were extremely sensitive to the quality of skins. One document describes over 8000 ray skins from a shipment of 9000 being rejected. Although it appears that the Dutch procured the skins mainly for trade within Asia, such incidents may account for the occasional reports we find of shipments to Europe – for example, in 1661.
the Hollantsche Mercurius reported the arrival in Holland of 900 ray skins.\textsuperscript{20}

A second likely source for the skins is the British East India Company. In 1799, Bernard Germain de Lacépède, the well-known ichthyologist, having identified the unprepared skins in the stores of wholesale dealers in Paris as the skin of ‘la raie sephen’, was informed that the hides were imported into France from England, but that the origin of the skins was unknown.\textsuperscript{21} The British East India Company was well positioned to purchase skins in India and China and records twice list the import of shagreen skins from 1682-1694,\textsuperscript{22} as well as the purchase of 400 shagreens in Canton from 1724-27.\textsuperscript{23} Although the records have yet to be properly explored, the earlier reports of imported shagreen may explain the source of raw material for late seventeenth-century English shagreen furniture as seen in figure 14.

The use of ray skin in objects made in Holland and England dates from around the mid-seventeenth century. The French started using the material some decades later, from around 1730. The Dutch were fairly limited in their output. In France and England, ray skin was more widely used – though primarily to cover small objects and cases rather than furniture per se. The material was also a popular covering for microscopes and other scientific instruments, its texture presumably aiding precise adjustment.

The extent of the trade in England is demonstrated by the existence of the recognized profession of shagreen casemaker from the first half of eighteenth century.\textsuperscript{24}–\textsuperscript{25} The trade card of shagreen casemaker John Folgham (figure 13) lists an array of cases and objects covered with shagreen, fish skin and blue or green dog skin. Willemsen suggests that, since ‘doggskin’ almost certainly refers to dogfish (a type of shark) skin, the separate mention of ‘fishskin’ must be taken to mean the only other fishskin which was used, that of ray’.\textsuperscript{26} The trade card lists fish skin and mahogany knife cases and shaving and writing desks are listed, suggesting several types of ray skin furniture from this period have not survived.

Figure 14a  Cabinet on stand. Wood, ray skin, rosewood veneer. England, c. 1685. Private collection. Courtesy of Sotheby’s, New York.
An unusual surviving example of a piece of furniture made in Europe is a cabinet on stand from England from the late seventeenth century (figures 14a, b). It has a rosewood interior and is covered entirely with shagreen. The eye holes—which have been patched—and the tapering end of the tales are clearly visible on the doors.

In eighteenth-century France the status of shagreen objects was elevated by Madame de Pompadour, who bought many green polished shagreen-covered objects from the craftsman Jean-Claude Galuchat. Galuchat became a sort of ‘brand name’ in France for shagreen, by which it is still known today. Again, the term is used to describe both ray and shark skin. The former is sometimes described as ‘galuchat à gros grains’, the latter as ‘à petits grains’.

Craftsmen in Europe used the skins intact, rather than removing and sprinkling the scales. The denticles were usually ground down and the skin was often dyed. It is possible that colored paper may sometimes have been placed behind the thinned translucent skin, as has been found with shark skin examples. Green was very popular but pink and other colors are also seen. In France, the sheen of the ray polished ray skin was often enhanced with an application of vernis Martin.

Ray skin furniture produced in Europe – nineteenth century

There was a significant lull in the use of shagreen in Europe through the nineteenth century. Gaston Derys, a French historian writing in 1926, wrote about the bedroom of Napoleon III at the Chateau de Tuileries being decorated entirely in shagreen. He describes how it took craftsmen three years to prepare and apply the skins. Unfortunately, the orders and receipts associated with this probably disappeared in a fire, and modern scholars have been unable to find any other documents to corroborate the information he gives.

However, shagreen was being used in Korea at this time. The ray skin was cut into shapes, dyed in bright colors and applied to the lacquered wood to form elaborate designs. Often used in combination with mother-of-pearl and brass wire and sometimes tortoiseshell, common decorative motifs include flowers, leaves and phoenixes. Low tables, treasure cabinets (kap-kae-suri), boxes and folding screens were all decorated in this way. The example seen in figure 15 is thought to have been used in the women’s quarters of an upper class...
Shagreen. The history and conservation of decorative ray skin in furniture

household. The cabinets open to reveal drawers of differing sizes.

**Ray skin furniture produced in Europe - twentieth century**

The word shagreen evokes above all the furniture of the Art Deco period in Paris. This style is characterized by fine craftsmanship and the use of rare and expensive materials. Art Deco designers known for employing shagreen include Jean Michel Frank, André Groult, Paul Iribe and Clément Rousseau. Rousseau and Iribe are credited with reintroducing shagreen to Parisian workshops. These designers made great use of its flexibility, stretching it over the curves of their furniture. They sometimes used the central ridge of larger scales to emphasize geometric elements of their design, or made a feature of the restrictions imposed by the relatively small size of the skins, by arranging them in a mosaic or tile pattern.

John Paul Cooper (1869-1933) and Omar Ramsden (1873-1939) of the Arts and Crafts Movement in Britain are also particularly noted for their use of shagreen in combination with precious metals and stones, making boxes and caskets as well as jewelery.

**Imitating makie?**

The use of sprinkled denticles embedded in lacquer is a form of decoration found predominantly on Japanese objects produced for export. Ray skin used on objects made for the Japanese domestic market tends to be applied as skins. This may in part be explained by the relatively large scale of the objects being produced for export – removing the denticles from the skins would have allowed large continuous surfaces to be decorated with an even pattern and without disruptive seams.

It is also clear from a text written by a Kyoto dealer of same (ray skin) in 1777, describing the characteristics and value of different types of ray skin, that many of the markers of quality are related to the natural arrangement and distribution of the denticles within the skin. Christine Guth argues that this technique may have been developed to mimic more cheaply the aesthetic of the traditional Japanese lacquer technique called nashiji - in which gold and silver flakes were sprinkled onto the wet lacquer surface. It is possible that the denticles of poorer quality skins and waste from skins used for the decoration of weaponry may have been used. Each samurai sword required the skin of one ray to create the distinctive ridged line of larger...
denticles running vertically down the centre of the hilt, so only a relatively small part of the skin would have been used in their production. 34

Three examples of lacquer coffers made for export demonstrate how Japanese craftsmen experimented with different sprinkled materials: silver flakes (figure 18); mother-of-pearl flakes (figure 19), and ray skin denticles (figure 6). The overall effect in each case is quite similar. Guth explains that European consumers might have been more willing to accept a variant style since their expectations were not based on an extended familiarity with lacquer or ray skin.

Imitating embossed leather?
A second way in which shagreen could be interpreted as an imitation of another material is revealed through an examination of the etymology of the word. Confusingly, in addition to shark and ray skin, there is a third materials referred to as shagreen: a type of untanned horse or donkey leather from Persia into which seeds were pressed to produce an embossed texture. This was often dyed green and used to make footwear (figure 20).

Although it is often suggested that the term shagreen derived from the French word ‘chagrin’, drawing a link between its definition of irritation and the fish skin’s abrasive quality, it seems more likely that it comes from the Persian ‘saghari’ or Turkish ‘sagri’ - words for the embossed donkey or ass leather – and was only later applied to shark and ray skin. 35 Persian leather goods were circulating in Europe well before trade with East Asia was established, and we know from the diaries of European travelers that they were familiar with the embossed leather.36

It is unclear whether the same term was deliberately or inadvertently applied to the two types of fish skin. It could be that the adoption of the term, and even the practice of dying it green was a deliberate way to associate the fish skin with an already popular, similarly textured material. However, the green color could also have been in imitation of the Chinese treatment of ray skin on bows.

Faux shagreen
A faux shagreen-covered tea caddy bearing the stamp of Jennens and Bettridge (figure 21), the preeminent British manufacturer of papier mâché wares (operational from around 1815 to 1864), suggests that shagreen was being imitated as early as the nineteenth century. Sometimes made from printed and varnished papers, early plastics, 37

Figure 22 A section of ray skin ground, polished and dyed.

Figure 23 Additional color variation was added using acrylics and watercolour.

Figure 24 A silicon putty mould was used to cast individual resin scales.
Shagreen. The history and conservation of decorative ray skin in furniture.

Vinyl or embossed mammal leather, many mass-produced early twentieth-century items also imitate shagreen. Today’s faux shagreen tends to be cast in resin and, despite lacking the translucency and subtle variation of the real skin, is quite convincing. It is sometimes even used on high end furniture.

Conservation case study – creating fills for ray skin

One problem encountered in the conservation of shagreen objects is the loss of denticles as the material becomes more brittle with age. There are several reasons why one might not wish to use ray skin to patch these areas. Firstly, there are ethical concerns. The trade in exotic skins is governed by CITES (the Convention on International Trade in Endangered Species of Wild Flora and Fauna). Shagreen currently falls into Appendix 2, which covers species not necessarily threatened with extinction. It is therefore legal and relatively easy to source shagreen. There is also an assumption that because rays are farmed as a food source in South East Asia that the skins are a sustainable by-product. However, farming does not always relieve pressure on wild populations. A recent report from the International Union for Conservation of Nature suggests that a quarter of sharks and rays are threatened with extinction.

Another reason to find an alternative to actual ray skin for fills is that it can be very difficult to match the skins, both in terms of denticial size, color (including its propensity to absorb dyes) and translucency, particularly as shagreen can generally only be sourced through the internet, so the skins cannot be examined in person before buying. Thirdly, it may not make economic sense to purchase a whole ray skin to replace a small number of missing scales.

Three different techniques were used to create fills for a shagreen handled walking cane.

For the larger area a piece of ray skin was used. This was ground down with an orbital sander, and sanded with increasingly fine grits of sandpaper until a smooth finish was achieved. The skin was then colored using Selladerm dyes, and some variation added using acrylics (figures 22 and 23).

In areas where just one or two denticles were missing, a mould was created from silicone putty to replicate individual denticles in synthetic resin (figure 24). Hxtal NYL-1 epoxy coloured with Orasol dyes was used to cast denticles, adding colloidal silica to modify the opacity. This was extremely time consuming, so in other areas a technique was adapted from one used in leather conservation. Layers of

Figure 25 Before treatment, showing missing denticles.

Figure 26 After treatment.

Figure 27 Before treatment.

Figure 28 After treatment.
Japanese tissue paper coloured with Selladerm dyes were built up with polyvinyl acetate. By tearing the tissue paper a very soft and unobtrusive edge can be created. The tissue paper also creates a slightly mottled, translucent effect which blends better than other fill materials. Watercolors and acrylic paints were used to replicate the pattern of surrounding scales. The fill materials were finally sealed with a coat of clear Paraloid B72, and the sheen modified slightly with microcrystalline wax. It should be noted that in this instance the ray skin had been ground and polished, and the area between the scales filled. On objects covered with textured ray skin, casting fills from a mould taken from the skin may be a more appropriate method.

**Conclusion**

Ray skin shagreen has a long history in the decoration of furniture. It may initially have been used by Japanese craftsmen as a cheaper alternative to sprinkled gold and silver, and later associated linguistically with an already popular, texturally similar material. However, ray skin was certainly also appreciated in its own right, earning notable periods of popularity in the eighteenth century and Art Deco period.

The material has continued to inspire designers from Wedgwood to Alexander McQueen, and many synthetic versions are now available. However, as discussed in the conservation case study, it is the very qualities that make it so appealing – its natural variation in scale size and translucency, the pleasingly variegated color achieved through its uneven absorption of dye - the fact that no two pieces of skin are alike – that make it such a difficult material to convincingly imitate.

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**Notes**

3. H.L. Joly and I. Hogitaro, The Sword Book and The Book of Same, privately printed, 1913. This is a translation of Ko Hi Sei Gi by Inaba Tsurio, published in Japan in 1785.
4. The most thorough effort to identify the species used by European craftsmen was conducted by W.H. Van Seters in his study of microscope coverings. In consultation with natural historians, Van Seters concluded that the skins were obtained from Dasyatis sp, with Dasyatis sephen probably being the most important species. It seems likely that other types of object produced in England at this time would have used the same material. W.H. Van Seters, “Shagreen” on old microscopes’, Journal of Microscopy, LXXI, 4, June 1951.
5. Joly and Hogitaro, 1913.
8. Impey and Jörg, p. 79.
10. Impey and Jörg, p. 78.
11. After the so-called Taiwan Incident of 1628, the Dutch Factory at Hirado was forbidden to trade for five years. Impey and Jörg, p. 83.
Impey and Jörg, p. 140.
16 Van der Veen, p. 156.
17 Occasional pieces of European-made weaponry pre-dating this period incorporate ray skin. The so-called ‘Sabre of Charlemagne’ at Kunsthistorisches Museum in Vienna, for example, dates from the first half of the tenth century, and is thought to have been made in Hungary. Presumably the ray skin used on the handle of this sword and other early objects arrived in Europe by The Silk Road.
18 Guth, p. 75.
19 Guth, p. 75.
20 Willemsen, p. 35.
21 Van Seters, p. 438.
22 India Office Records and Private Papers held at The British Library.
23 The Diary and consultations of the council in China (1724-25 and 1726-27) from the India Office Records and Private Papers held at The British Library.
24 The London Trademan explains that the shagreen casemaker ‘is employed in making Shagreen Cases for Watches, Tweezers, &c. and Chests for Plate’, listing educational requirements and salary expectations for masters and journeymen. R. Campbell (Esq.), The London Tradesman, 1757, p. 255.
25 The National Archives at Kew contains seventeen wills and twelve insurance documents of shagreen case makers (one overlap) and two ‘Bill and Answer’ court documents referencing two further shagreen casemakers. These date from 1740 to 1830, although the vast majority are from the second half of the eighteenth century. Additionally, The London Magazine, Or, Gentleman’s Monthly Intelligencer, XXXVI, January 1767, p. 148, lists the bankruptcy of shagreen casemaker Elizabeth Heath. Therefore, at least thirty-one – and probably many more - shagreen casemakers were working in England (primarily in London) in this period.
26 Willemsen, p. 38.
28 Perfettini, p. 16.
29 Willemsen, p. 37.
30 Perfettini, p. 28.
31 The Asian Art Museum in San Francisco has several examples of nineteenth- and early twentieth-century Korean furniture decorated with ray skin.
32 Perfettini, p. 39.
33 Joly and Hogitaro, 1913.
34 Guth, p. 74.
35 Van Seters, p. 433.
36 Guth, p. 85.
37 Examples of several items made in the 1930s from cellulose nitrate and cellulose acetate in imitation of ray skin can be seen in the collection of The Museum of Design in Plastics: www.modip.ac.uk.

Supplier list

• Micro-Mesh
  Scientific Instrument Services, Inc.
  1027 Old York Road
  Ringoes
  NJ 08551-1054
  USA

• Selladerm dyes
  The Leather Conservation Company
  University Campus
  Boughton Green Road
  Northampton
  NN2 1AN
  United Kingdom

• Orasol dyes, Paraloid B72, Hxtal NYL-1, polyvinyl acetate resin, Renaissance microcrystalline wax
  Museum Services Corporation
  385 Bridgepoint Way
  South St. Paul
  Minnesota 55075-2466
  USA
From ‘real composition’ to ‘higher matters of taste’. Exploring the value shift from materials to design in early British composition ornament

Victoria Coibion

Introduction
In the history of the decorative arts, many materials have been used to create relief ornament. This paper is specifically concerned with one of these materials which is described as ‘composition’ or ‘compo’. Unfortunately, these terms have often been used generically or indiscriminately to describe materials which, while relevant to any comparative discussion, are not the primary concern of this paper. This can cause confusion in the interpretation of historical documents and in discussions of both a historical and technical nature. Today, composition and compo are most generally used to describe a particular material composed of four major ingredients (raw linseed oil, rosin, Scotch glue and whiting) and possibly several other minor components. This paper is specifically concerned with composition or compo so defined. 1

The aim of this paper is to challenge the commonly held perception of compo as a largely imitative, mass produced, cheaper alternative to wood carving and therefore second-rate. The questions below seek to examine and identify the attitudes of the retailer and consumer to composition from its beginnings in the late 1700s to the point at which those attitudes changed.

Was compo ever presented as a truly innovative material?
What part did the physical qualities of the material play in forming attitudes to compo?
What do advertising methods communicate about the status of those at whom it was aimed?
What evidence is there for a wider, more architectural use and did that subsequently narrow to a more limited application on frames?

Evidence takes the form of trade cards and catalogues, together with excerpts from advertising based sources such as The Art Union. Effort has been made to show critical awareness of bias or simple miscalculation of the market, hence sources such as account books are essential in achieving a balanced picture. 4 These are supplemented by physical evidence in the form of wooden moulds and the decoration/objects they produced. A full discussion of the wooden moulds is beyond the scope of this paper, however, a few examples are provided within the context of this paper where they are of particular relevance to the discussion or are linked to other key information presented here.

Analysis is concentrated on the earlier period up to around the middle of the nineteenth century. This is because the bulk of information exists for this early period for reasons clarified shortly. Other caches of chronological evidence help to delineate changes over time, in particular through the development of the London composition manufacturing firm of George Jackson & Sons.

The evidence
A consideration of prevailing attitudes to the subject of imitation in the late eighteenth century helps to place the following extracts in context: ‘In eighteenth-century France and England, as is clear from their literature on aesthetics and technology, imitation was as accepted as it was accomplished [1, p. 1].’ However, ‘Eighteenth-century theorists addressed imitation only as an intellectual problem, and only in the context of the fine and liberal arts [1, p. 1].’ It is not until relatively recently that the decorative arts were considered ‘worthy’ of such consideration and within this, composition’s place remains undefined.

It is clear that craftsmen often used imitative materials to enhance, elaborate on, or improve upon nature, for example, in the landscape architecture of ‘Capability’ Brown and it is quite evident in almost every area of the arts at this time. Faux coral is another example, which, through the use of artificial materials could be made into remarkable forms lacking by the genuine article but suggested by the latter. More importantly however, the impetus to do this did not come from the lack of coral at this time but was fuelled by taste. Imitation in the eighteenth century then was not content with ‘merely’ deceiving the observer but an often exhaustive search for a trickery which could amaze and delight beyond the bounds of nature itself. Novelty was everything and if that novelty came
From ‘real composition’ to ‘higher matters of taste’. Exploring the value shift from materials to design in early British composition ornament.

Cheaply then so much the better. However, the use of imitative materials at this time had often nothing to do with economy, for example the use of ivory for door cases in Syon House when the shutters in the red drawing room are of gilded lead and the floor of the anteroom is of scagliola.

Trade cards are a major form of evidence for the way in which compo was retailed and consumed in the early years. They were one of the means by which semi-luxury goods of all kinds were advertised. Although very few trade catalogues or pattern books have survived, their use is indicated in some of these early cards.

The cards which are exclusively those of composition manufacturers or makers all post-date 1780. It is clear from the language used that these are some of the earliest cards describing compo when it was fairly new on the market. There is not so much a strong sense of the novelty value afforded by the new material, as assurances of its authenticity in descriptions such as ‘Real composition’, 3 ‘Barker’s Original manufactory For Composition Ornaments’ 4 (figure 1) and a shop bill of 1792 from the ‘Original Inventor of the Composition’ (figure 2).

Composition is depicted as a desirable, innovative material in a very similar way to patent medicine. The physical qualities of the material are never directly alluded to, but its resultant advantages such as the cost of goods and the speed at which they could be supplied are usually very prominent: ‘Those who promoted novelties often had to face the active hostility of vested interests, such as the manufacturer of substitutes or near substitutes ... [2, pp. 124-169]’ The use of language suggests that compo, in common with patent medicine, was produced in a variety of formulae by different manufacturers, each trying to reassure consumers that theirs was in some way superior to the others. Patent medicine was usually heavily branded however, precisely because formulations were not necessarily so different from one another. As these cards do not advertise the benefits of the actual formulation, it is impossible to determine whether they refer to the four-ingredient material or something similar from this evidence alone. But in not mentioning the formulation, the notion of trade secrecy and therefore the idea that the formulation is desirable through its unique physical properties is promoted.

Physical advantages of compo over carving that would be quite apparent to the consumer included the range of stock mouldings of which a ‘Large

![Figure 1](image1.png)

Figure 1 Trade card of Barker (c. 1790s), (British Museum, Heal, 47.1).

![Figure 2](image2.png)

Figure 2 Shop bill of Lane (1792), (British Museum Heal, 47.8).

![Figure 3](image3.png)

Figure 3 Trade card of Jaques (c. 1799), British Museum, Banks 32.35).
Assortment is always ready for Inspection - Dimensions to Any Size or Pattern’ (figure 3, 1784-1790). This is strongly connected to the growth of retailing at this time, particularly the success of shops, from which many of these producers were selling their goods. Furthermore, the ornament they produced was being used to decorate them. In addition to this ready-made service, descriptions stress a far more individual service of the type customers would be used to when commissioning carved works. For example, the ‘sketch and pattern provided’ for designs, noted on Jaques’ card, verso, 1799. Other clear physical advantages, and in particular the flexible qualities of compo when newly cast, include the use of compo for ‘Circular work’ which required considerable skill, planning, and above all time when executed in carved wood (figure 4). Such work would be extremely costly. The advantages of compo for updating ‘New or Old Woodwork’ is a recurrent point in these early and later cards, also recalling object and archival evidence. For example, the frame surrounding The Linley Sisters, c. 1772, by Thomas Gainsborough (1722-1788), figure 5. This neoclassical frame with fluted frieze dates to between 1770 and 1800, after which time the cavetto or scoop profile became more popular. The sight and top edge are a beautifully carved ribbon and stick, though the back edge ornament is moulded and this may be true of the beading. Simple acanthus corners in compo placed over the mitres are visible beneath the later and much larger Regency additions applied to the top edge. The first leaves are probably original and indicate that compo had been used on frames before the Regency, but they do not suggest more than this.

Affirmations of ‘short notice’ and ‘Foreign & Country Orders particularly attended to & executed with Dispatch’ communicate the speed at which ornaments could be supplied. This also indicates the scale on which compo was produced and consumed and the level of demand for such goods from foreign customers shopping in London at a time of considerable economic trouble. In addition, it highlights the role of London as the eighteenth-century centre for the dissemination of new ideas and materials. As speed was one of compo’s distinct and obvious advantages, it would be a key difference worth promoting in relation to carving in the minds of the consumer whether a direct comparison was made or not.

Direct comparisons to carving point to a period of transition from carving to compo. For example, in the compo maker Jaques’ earliest card, his busi-
ness is described as: ‘Jaques & Son, Ornamental Wood Carvers’. The composition ornament maker Thomas Poyntell’s direct comparison: ‘as neat as any carving’ provides confirmation of a ‘transition’, in addition to reassuring the consumer by stressing the similarities of compo to carving (figure 6). The fact that compo (like Sheffield plate compared to silver) could be rendered visually indistinguishable from carved ornament through painting or gilding, enabled such a comparison to be made. This points to the motivation for the development of compo as both imitative and innovative.

Crucially, this comparison serves to fix the idea of composition’s viability as an alternative to wood carving in the mind of the consumer. But at the same time it strongly suggests that compo was regarded as a direct imitation of carving and that consumers really valued wood as the genuine article. This type of marketing method endorses the theory that the consumer, skeptical and opposed to change, would only accept new materials and techniques if they were perceived to be as good as or indeed better than the original. This compromise or particular form of novelty is important because it indicates that consumers would only accept new ideas and goods if they were associated with comfortingly familiar elements. Therefore, if goods were presented as too radically different they faced rejection.

The newness of the new product had to be reconciled with consumers’ pre-existing experience, knowledge and expectations. Innovation had to be domesticated in almost every sense of that word, from the national to the personal. Consumers had to be offered an idea of the new artefact’s potential (both practical and symbolic) which they could recognise. It is for this reason that so many of the new products came to incorporate references to precisely familiar objects. Product innovation demanded of the supplier not just persuasion and education, but compromise and sometimes concealment [2, pp. 124-169].

Furthermore, ‘eighteenth-century manufacturers relied heavily upon the archaic model in their efforts to overcome resistance to innovation [3, p. 12].’ This method of enhancing product difference by drawing attention to similarities with the tradition model was well understood by manufacturers/retailers by this time. Through these means they were able to provide assurances without directly alluding to the material. In this way, Josiah Wedgwood (1730-1795) reproduced the Portland Vase (1790), his new techniques and materials showcased far more effectively through compari-

son than through a completely new design [4, p. 16]. His comparisons also served as publicity stunts as he understood the mass market very well:

I know they are much cheaper at the price than marble, and every way better, but people will not compare things which they conceive to be made out of moulds, or perhaps stamped at a blow like the Birmingham articles, with carving in natural stones where they are certain no moulding, casting, or stamping can be done [5].

Artificial materials were successful precisely because they were a good imitation, or even an improvement on the original or traditional. The late eighteenth-century consumer’s attitude was therefore both skeptical and novelty driven.

The scale of businesses and the range of products Early cards reveal the broad range of uses to which compo was applied. The looking-glass frame and the chimneypiece feature widely, the latter still such an important part of late eighteenth-century decoration. There is one piece of advertising that may present evidence for the earliest batch production of compo. This is part of a catalogue, the main plate entitled ‘No. 303 Chimney-piece complete’: The numbers on the Chimney-piece, refer to the single Ornament, engraved full size: & are sold separate or compleat ________. Their Elegance, Duration, & Cheapness are better recommended by a comparison with other Carvings ________ [6].

Although compo itself is not mentioned, it is clear that the subject of this piece of advertising is a substitute moulding material. There is nothing to immediately suggest that this was not metal, yet the comparison to the material and aesthetic qualities of carving, and low cost, suggest that the material used here was both perceived as imitative of carving and retailed as such. Each design element on the chimneypiece refers to another plate where they are featured ‘full size’ showing how a design could be made up of a variety of different elements of the purchaser’s choice. Two of the plates are dated 1776 and 1777 with the name J & O Westwood. It is almost certain that this is Obadiah Westwood, the Birmingham button manufacturer and patentee of a 1786 compo recipe; Westwood may have used his recipe some time before obtaining a patent. If this was the case, then compo was used before Jackson’s (unsubstantiated) 1780 claim to its origins [6].

The scale of businesses is indicated by cards like that of Thomas Poyntell (1783-85), who produced work for ‘Architects, Builders and Artificers’ and...
'Funerals decently performed on the lowest terms'. Picture frames also feature frequently in these cards and in pre-compo examples indicating a level of demand that continued. Many of the cards of allied trades predating 1780 are those of carvers and gilders. However, after the emergence of compo in these cards there is no noticeable decrease in the numbers advertising in trade directories. The cards of carvers, on the other hand, advertised only a basic range of traditional goods and services, like the earlier of the two cards of William Wade (c. 1780, figure 7). However, Wade’s later card has the additional statement: ‘Composition Ornaments for Chimney Pieces’ (figure 8), indicating that those engaged in existing, traditional trades were keen to be part of new activity.

The advertising of other competing materials
Having established the emergence of the compo manufacturer around 1780 via trade cards, there is a clear distinction between the way in which compo and allied and competing trades were promoted. The card of ‘Thomas Brown Plaisterer’ is more conventional than those of compo makers because, although stressing the authenticity of its product: ‘All Sorts of Plaister of Paris, truly prepared for all Artists without any Adulteration’ it is devoid of all the other language suggestive of novelty (figure 9). Plaster of Paris was an old and familiar material and plastering a long established trade. It probably dates from the late eighteenth century and shows how older related and competing trades besides carving never went away.

The style of cards to promote their product
Instead of using the text, it is the images that were used in the majority of cards to promote the style or design of the ornament. Indeed, they went beyond this and delivered a message about the social status that the goods might bestow on those who purchased them. This is very much in line with trade
cards at this time, which relied as much on the image as the text.\

The distinct formats to the cards changed with time and are closely linked to the point of sale. A common device is used in the card of the compo maker Barker, following a classical theme with figures, sculptural elements and a stone tablet on which the information is written (figure 1). This type of card may have been old fashioned by the 1780s and not commonly used for compo, however, its purpose was to sell the classical ideal through the use of ‘identifiable icons, whose presence transcends any particular material’ [4, p. 197].

Another simple form popular in earlier cards and trade sheets from around the 1760s is the fine-patterned border that mimics needlework (the framing of which is frequently advertised). A good example is the earlier card of William Wade c. 1780 (figure 7), which does not really communicate with the consumer, however, Wade’s card changes to reflect the style of ornaments that were being retailed as he makes the transition to compo (figure 8). The number of other compo makers make good use of ornament and the chimneypiece in particular. Trade cards were also an expensive form of advertising and this may have been a factor for those using older designs.

A further design among the cards of Jaques (figure 10), dating from between 1784 and 1801, features a royal crest. Claims of royal and aristocratic patronage were common in the eighteenth century. Their intention was to foster an image of high quality goods for an elite clientele of high social status but without using the goods themselves, and they are similar in this way to examples that make use of classical imagery. This is important because it has been argued that compo goods were what might be termed semi-luxury commodities because they were not custom-made on commission at the highest level [7, p. 187]. However, compo designs could be bespoke just like carved objects. New, unique moulds could be commissioned for specific tasks and to the taste of particular individuals to create an exclusive and totally hand-crafted object. The fact that a maker may subsequently have re-used the mould does not detract from this fact. For example, Jackson’s were able to secure the restoration of frames at Windsor Castle precisely because they recognised an unusual design for which they had the original mould (figure 11).
vice versa) can be located remain rare however. Another example is the pair of Regency cabinets in figure 12, each mounted with a pair of compo crocodiles identical to those from the ‘A’ and ‘B’ moulds in figure 13 bearing the initials ‘SJ’.10 The weight of evidence for crocodiles as a design feature in the early nineteenth century, and the fact that they are entirely in accordance with the date of the cabinets, argues against their being added at a later date. The cabinets can be dated to at least as early as 1825, but the crocodiles represent Nelson’s victories at the Battle of the Nile (1798) and Trafalgar (1805).11 They are very similar to ormolu mounts on the Nelson Vase (figure 14) supplied by William Collins to John Fish around 1810, but they are smaller and certainly not identical.12 The moulds may therefore have been carved shortly after such examples, either using them as a model or perhaps using a printed source.

Trade cards of the 1820s and 1830s provide evidence of further developments, often using the picture frame as a pictorial device. Figure 15 shows a highly decorative sweep sided frame that was fashionable but by no means new at this time. Such evidence supports that from the earliest Jackson account book (1805-1818) that the demand for frames was strong. Although popular in the eighteenth century, cards sometimes used a shop front or interior (figure 16, c. 1827) to remind the consumer of the particular goods purchased there and the retail experience in general. The card of George Sully is slightly later and aimed at the trade (figure 17, c. 1840). Despite the range of trades supplied with ornament (including for example the manufacture of letters) the design of this card again suggests that at this date, frame-makers were among the primary customers. George Sully may be linked to moulds bearing the initials ‘GS’ (figure 18) hand-carved into one of the faces of a mould carved on both sides and thought to date from the early 1820s.13 The gothic revival ornament is consistent with this date and could have been used to decorate the early ‘Upright Gothic Piano Forte’ from 1826 (figure 19).14 Why Sully (or the individual responsible) carved as opposed to stamped his initials (as is sometimes the case) remains unclear. His ownership, as distinct from authorship, is not indicated by the extra time taken to carve the initials but does reveal the level of care and pride with which these objects were created.

Sully, like Jackson’s also had the expertise to produce compo ornament and to carve the moulds.
Although composition making was not a craft necessarily demanding great specialisation, it did rely on the moulds, and thus if a frame-making workshop were to produce compo ornament on their own premises, they would need a reasonable stock of these. The acquisition of a stock of moulds would require a substantial expansion of the business in terms of space and cost. Furthermore, continued outlay would be necessary to replenish the existing stock with the latest designs. As compo designs would keep for several weeks if carefully wrapped, the obvious course would be to buy these designs ready-made from the specialist manufacturer. Compo making required relatively simple ingredients, the majority of which could be found within the frame-maker’s workshop, but it did require a degree of skill developed over time. Many frame-makers, too busy with other processes, could choose not to invest when the pressings could be purchased ‘ready-made’. The applied decoration of early nineteenth-century musical instruments indicates that designs were bought in from compo makers as such a trade was obviously highly specialised (figure 20). Therefore, carved moulds were specially commissioned for certain tasks.

The durability of the material

Millar’s historical (late nineteenth-century) text extolling the virtues of compo on shop fronts corroborates information from the earliest trade cards: It [compo] was largely used in Edinburgh, Glasgow, Dublin, and other towns for the decoration of wood mouldings on shop fronts, many of which are still in existence, and the composition seems harder and in a better state of preservation than the wood work on which it was fixed. This gives ample evidence of its durability, [my italics] even when exposed to all weathers [8, p. 297]. Although no surviving examples have been located, an early catalogue (c. 1830s) is entirely devoted to these façades made in papier mâché. It is possible that these or similar designs were also made up in compo, perhaps at a slightly earlier date, strengthening Millar’s reference. The fine detail achieved with compo was surplus to requirements in this instance, and bulky designs would be extremely heavy. The durability of compo may have been a problem, despite the fact that Millar indicates the quality of examples that survived at least to the end of the nineteenth century. Durability is also noted quite frequently in relation to papier mâché, thus the physical quality and durability of a material were usually critical to its acceptance. Part II of Jackson’s 1839 catalogue still survives
where they describe themselves as ‘Composition ornament and improved papier mâché and carton pierre manufacturers, modellers, carvers, and workers in ornamental Roman Cement and Plaster of Paris’ [9]. Composition is still afforded a relatively prominent position. Their promotional assertions at the beginning of this catalogue provide insight into both the aims and practices of a major manufacturer of compo at this time and some clues as to the demands of their customers. The language shows that novelty now lies almost purely in ‘design and increased feeling and beauty of execution’ and no longer in the material itself. Design and ‘higher matters of taste’, which had been important to the late eighteenth-century consumer, had become far more important than the type of casting material used. Nevertheless, references to carton pierre and improved papier mâché, which feature heavily in the catalogue for the first time, seek to reassure consumers that material deficiencies such as the stability of the material over time have been resolved. Clearly concerns about the durability of materials, which had always been an issue, had not disappeared.

The 1840 catalogue of the Queen’s decorators H.W. & A. Arrowsmith is partly aimed at the trade and indicates that a broader range of materials, old and new, were now available to the consumer for various elaborate architectural schemes:

The ornaments shown in our design are to be in relief; and may be made of composition, plaster of Paris, or any substance which can be run in moulds, or formed by a tool. Some persons prefer the introduction of carvings in wood; but the expense is greatly increased, and but little advantage is gained either in appearance or strength [10, p. 20].

Even though the most eminent decorators of the day advocated the use of moulding materials, it is clear that their customers sometimes preferred carved wood. Similarly, an extract from The Art Union expresses a contemporary (1842) view of papier mâché. The purpose of the journal was to report on novelty and innovation as a marketing resource for firms. All the uses towards which papier mâché is directed here include those associated with compo, but its advantages over compo are much promoted. However, the comparison to wood carving is still there, implying that carving was still considered the benchmark of quality by which cast materials were measured:

... picture frames which, bid fair to rival the best carving in wood ever applied to the same purpose,

The frames of Mr. Bielefeld present the best...
characteristics of fine carving, the course of the chisel, though subdued, is everywhere apparent, and the liberal resort to undercutting, and occasionally nearly alto relief, realise the peculiar finesse and spirit of the best manipulatists amongst the old carvers in wood; substituting, for the dull, prim, and mechanical mediocrity of works in putty composition, an easy, liberal and artistic dexterity in the execution, ... they are liable to no injury from chipping, as the common frames are; we have seen the effect of a picture entirely ruined in consequence of the frame being shattered during transit. An essential advantage also is, that these frames weigh no more than half the weight of the usual frames of the same sizes [11, p. 61]. Weight and durability could be a significant problem for compo no matter how satisfactory the recipe. The journal devotes much energy to the aesthetic superiority of papier mâché, its ‘rare artistic qualities, which are lost at the height of a room or the summit of a column’, precisely because it produced ornament that lacked the crisp detail of composition. In an effort to convince readers that problems with ‘durability in any atmosphere’ had now ‘ceased to be a matter of doubt’, this extract reveals that the durability of papier mâché was still an issue. Through direct comparisons, it is clear that despite composition’s failings it still retained a place in the market of 1842. Nevertheless, the production of frames in papier mâché may have presented some competition [11, p. 257].

The continued use of old and ‘new’ casting materials

Within the same journal, an advertisement of C.J. Eckford from 1841 indicates that picture frames were still using compo (figure 21). The primary emphasis here is on low cost but reinforced by the range and quality of available goods and services. A slightly later advertisement (1844) from the same firm cites a ‘splendid and extensive stock of picture frames...in imitative oak, from 20s. upwards’ showing that there is no attempt to disguise the use of emulative materials and suggesting that they were now regarded as important in their own right’ [12, p. 274].

One entry within the earliest surviving customer account book of Jackson’s (1805-1818) provides a fascinating record of Eckford’s operations during the early years of trading. It shows above all that his frames were made by Jackson’s [1, pp. 91-92]. Jackson’s completed all the work except the gilding. For example, ‘ornamentg’ [sic] refers to the application of composition ornament; ‘sweeping’,

Figure 20 Detail of applied compo decoration to a harp made in 1815 by Sebastian Erard (Collection of Mike Baldwin).

Figure 21 The trade sheet of C.J. Eckford (c.1841), British Museum (1997, U.73).

Figure 22 The conservation of one of two identical frames surrounding Lord Percy under attainder and Watteau Painting, both by J.W.M. Turner, exhibited in 1831; this example demonstrates ‘cutting Through’ (Frames Conservation, Tate Britain).
the cutting of the curves for a sweep sided frame; ‘witing’ [sic], the gesso; ‘cutting through’ refers to the piercing of the ornament in frames such as those surrounding the Turners’ from 1831 (figure 22), and finally ‘chequing’ refers to the cross-hatch pattern in the gesso (still created by hand with a carving flute or similar tool at this time). At the time of the ledger Eckford’s involvement seems largely to have been retail - buying frames wholesale from Jackson’s and providing the desired finish, and there is no reason to believe that Eckford’s business operations had much changed by the 1840s. There are some important differences however. Comparing the retail prices of frames in the 1840s trade sheet to the trade prices in the Jackson ledger, prices in fact came down over a period of twenty-five years [1, pp. 112-120]. The ledger indicates that the styles were very similar to those of the later trade sheet. However, the early examples from the ledger had numerous pierced areas of decoration whereas by 1841 Eckford was no longer providing this considerable extra refinement. This had to be done by hand and thus frames could be more competitively priced by reducing refinements. Examples matching these patterns show that quality could be reasonable and still produced with traditional moulds, although ultimately quality was compromised (figure 23). These frame types were purchased in large quantities by collectors such as John Sheepshanks (1787-1867) and Richard Ellison (1788-1860) to frame their contemporary collections of oils and watercolours and were widely used at this time. Demand ensured competition which kept prices down, although these prices were still only within the reach of the upper-middle classes at this stage. Despite the lack of refinements, each object was still individually produced. Another excerpt from The Art Union gives a view of composition in 1846, through the firm of George Jackson on whom the commentary is based. It is not many years since ‘composition’ was almost the only material employed to imitate carving, and in its early application little other use was made of it than the decorating of doors, shutters, chimney-
pieces, etc. The style of architecture in vogue, at the time this invention was first introduced, was peculiarly suited to the mode of production best calculated for this material; and many houses in the metropolis, particularly those erected by the Messrs. Adam, the architects of the Adelphi, are profusely decorated with composition ornaments. Improved taste soon required that the material, or some other, should be rendered capable of more extensive development, and that works in high relief should be produced; to this may be traced the origin of many of those attempts that are constantly made to bring in to use other materials, and several compositions have been devised possessing different degrees of value according to the purposes to which they are to be applied [13, p. 53]. Although this extract gives a nineteenth-century view of the eighteenth-century use of the material, the relative merits of the various materials within the class at this period were well understood. It was the taste in the 1830s and 1840s for ornament in high relief with undercuts that provided the impetus for the constant attempts at developing different materials.

By 1846, producers were finding new ways to use old and ‘new’ casting materials. Such methods of production were considered innovative and composition was recognised as adding value, not taking it away ‘as much greater elegance may be gained than by adhering too rigidly to the monotonous repetition of castings, to which they [architects] now resort [13, p. 53]. Those objects ‘where part of the design required a greater delicacy of finish ... have been mounted with composition’ [13, p. 53]. The staircase (figure 24) is an example of the combined use of materials to produce an object whose design is influenced by the use of these materials. The basic shapes were made of hardwood and the foliage enrichments ‘coated on’ in composition: ‘By this means a very elegant effect is produced, and a large amount of expense saved [13, p. 53]’. Again, it is the way in which the material is used here and not the material itself that is said to be new or different.

By 1874, the catalogue of the furniture company James Shoolbred illustrates, through entire room schemes in specific styles in addition to individual pieces, the change in the way objects were now displayed and consumed [14]. Many examples undoubtedly relied upon composition for their decoration (figure 25). At this point, compo was no longer considered a novelty and is rarely mentioned. This catalogue is aimed at the now far wider, middle-class retail market that demanded decorating ideas. Naturally, large manufacturers like Jackson’s would have relied on the trade. Manufacturers then, as today, were fulfilling a dual role and catering to the retail sector through a shop, often with the factory or workshops behind. This would provide a visible presence, always a primary form of advertising.

By the 1870s, compo had long since ceased to be retailed as an important material in its own right. It is not mentioned in Jackson’s 1882 catalogue of ‘Cornices’ at their ‘Carton Pierre, Papier Mâché and Patent Fibrous Plaster Works’ [15]. Their 1885 catalogue of ‘Architectural Ornaments & c’ is concerned with patent fibrous plaster and carton pierre only [16], and their 1889 catalogue of the same name mentions a wide range of materials, but again, compo is excluded: ‘Papier mâché, carton pierre, plaster and cement manufacturers patentees of the canvas plaster; wood carvers & c.’ It is felt to be significant that this 1889 catalogue is the first in which Jackson’s state that they were established in 1780. Competition from specialist machine manufacturers and the constant development of materials may have driven Jackson’s to foster an association with Adam as a marketing tool, particularly at a time when neoclassicism was enjoying renewed popularity.

Summary

Compo was retailed as a novelty but was compared to familiar, traditional woodcarving to render it acceptable to the innately skeptical eighteenth-century consumer. By the middle of the nineteenth century, evidence indicates that compo added value and was marketed as a desirable material in its own right, although it was the design made possible by the material and not the material itself that was important to consumers at this point. Early comparisons to carving indicate that compo was a very recent introduction in the 1780s in England. As compo was retailed in a similar way to patent medicine, the formula was deliberately kept secret to create the idea that it was desirable through its unique physical properties and to keep it out of the hands of potential competitors. This implies that there was actually not a great deal of difference between one formula and the next in terms of its handling qualities. Although the formula is concealed, it is clear that the material to which the cards refer had the same physical characteristics as the compo with which this paper is concerned. For example, its use for ‘Circular work’. The appearance of compo recipes
within trade manuals by the 1820s marks the end of a period of novelty and thus a relaxation in trade secrecy surrounding early developments.\(^{18}\)

Early cards further confirm diversity within the structure of the trade and support the evidence of surviving ledgers for the carving, gilding and frame-making trades. The material would need to have the physical properties of compo to sustain these operations. It is also clear that producers supplied both the wholesale and retail market, some firms, catering more to one than the other.

The earliest cards confirm the broad range of applications, which subsequently narrowed to use predominantly but not only on picture frames in the early nineteenth century. By contrast, larger producers such as Jackson’s seem to have reverted to a mainly architectural output by the 1830s and it is the carvers, gilders and frame-makers who continue frame production in compo for the most part, though there are exceptions.

The use of card designs to equate goods with the idea of exclusivity and discriminating taste, in line with the advertising of other goods at this time, was a means of overcoming skepticism surrounding moulding materials, and of offering reassurance. It was not necessarily an indication that the goods were made in an inferior way to carved goods, at least before the introduction of machinery, as is the frequent interpretation.

The visual imagery of retailing literature suggests that although compo production was essentially a batch production, producers were still targeting the higher end of the market. Although the beauty of compo was that repeat patterns could be produced at speed, compo designs, for the most part, were a direct product of the intaglio carving skills, and good casts directly reflect these skills. Work could be custom made at the highest end of the market. Many objects decorated with composition have no less rich a provenance than their carved counterparts, although they are considerably more complex. The fact that compo was used to modernise outmoded designs both during neoclassicism and the Regency runs counter to the argument that compo was used in a purely imitative way.

Durability clearly was, and still is a key issue for all products. The fact that so many compo objects to have survived are in very poor condition points toward damage and deterioration as a major factor in forming compo’s reputation as a poor quality mass-produced material. However, it is important to remember how these objects would have appeared when first made.

**Notes**

1 For a more complete discussion of composition the material, see [1].

2 It is fortunate that one ledger of customer accounts from the major compo producer, George Jackson & Sons, dated 1804 but containing information from the years 1805-1818, has survived the destruction of much of their archive material. See also Chapter Three [1].

3 Jaques’ card of 1790.

4 Date unknown but thought to be in the 1790s.

5 Perceval Collection, Fitzwilliam Museum, Cambridge. Jaques seems only to have been known as Jaques & Son for a short time in the early 1790s, according to the trade directories, used to assist the dating of these cards. See Appendix I [1].

6 For further information on this subject see Chapter Three in [1], pp. 81-83.

7 See Berg, Maxine and Clifford, Helen, ‘Commerce and Commodity: Graphic Display and Selling New Consumer Goods in Eighteenth-Century England’, in [5, p. 188].

8 Wade is noted in trade directories at 86 Leadenhall Street, removed from the earlier address at no. 42.

9 The same chimneypieces continue to feature in Jaques’ cards. That of 1799, shows an alternative design, although still of neoclassical inspiration.

10 The provenance traces these cabinets to Embley Park, Hampshire, home of Florence Nightingale and her family from 1825. They may have formed part of the contents of their previous home, Lea Hurst in Derbyshire. See lot no.184 in Sotheby’s, ‘Fine English Furniture’, London, 22 March, 2002.

11 Very similar crocodiles can be seen forming the hilts of swords at the same date.

12 See: Gleeson, Janet, ‘John Fish and the Dolphin furniture at Brighton Pavilion’, Apollo (September 1997) [pp. 9-13]. This article notes that William Collins had a glass manufactory at 277 Strand and that he was ‘a celebrated maker of pier and chimney glasses and lamps’. It is therefore most likely that he was well acquainted with the work of compo manufactories in London, although the precise nature of his operations requires further investigation.

13 As listed in London trade directories under both ‘carvers and gilders’ and ‘compo ornament makers’. 

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
From ‘real composition’ to ‘higher matters of taste’. Exploring the value shift from materials to design in early British composition ornament

There is clear evidence that composition ornament was used to decorate pianos at this time and other musical instruments such as harps. See [1, p. 90]. Although undated, this date was assigned because Jackson’s were at 50 and 49 Rathbone Place at this time (from their catalogue). The styles also suggest the late 1830s, in addition to the fact that two other catalogues are known to have been produced in this decade. 

Another late seventeenth-century example of consumer resistance to the quality of new goods was the failure of the East India company to sell imported cotton shifts over those made of the traditional linen because they were not as durable and the quality of the sewing may also have been a factor [2, pp. 124-169].

A note in the text refers to this second part of the collection as ‘Various Articles of Taste and Furniture’.

See also Chapter Two, [1].

References

• 27 plates from a catalogue of designs, Department of Prints and Drawings, Victoria and Albert Museum, M.64g / E.1467-1493-1907.
• Jackson, George & Sons, Part II of the Collection of G. Jackson & Sons, manufacturers of Composition and Improved papier mâché, London, Jackson (1839).
• The Art Union (1842).
• The Art Union (1844).
• The Art Union (1846).
• Jackson, George & Sons, Cornices, London, Jackson (1882).
• Jackson, George & Sons, Architectural Ornaments &c., London, Jackson (1885).
Special coloured inlays on furniture in the mid-nineteenth century.  
Imitation of lacquer, ivory or horn?

Carola Klinzmann, Stefanie van Wüllen

In Germany, a special type of coloured inlay was used for only a relatively short period of time, from 1840 to the mid-1850s. There have already been a few articles written concerning individual cabinet-makers or companies who worked with these coloured inlays, but the technique is not mentioned specifically or in detail. This article will list pieces of furniture with these coloured inlays and present, in particular, two secretaries from the Wack Company in Kassel. The examination of and research into the materials used will be presented. This research was done by Stefanie van Wüllen in the course of her diploma thesis. The technique and the manufacturing process of the coloured inlays will also be explained. Although this kind of marquetry had been utilised in renowned workshops at the time, it is only a fringe area of ornamental technique and has been little noticed until now. To gain a better insight, it was necessary to attempt a reconstruction.

Furniture and cabinetmakers/companies

The few pieces of furniture with coloured inlays which are known are located all over Germany and were produced in Lübeck, Hamburg, Kassel, Würzburg and Munich. Almost all the pieces are marked with a year and/or company name. Their common feature is the use of rosewood veneer. Furthermore, multi-coloured metal inlays, mother-of-pearl and ivory can be found. The earliest known marked piece of furniture is from 1842.

In the following table the cabinetmakers and their well-known works with coloured inlays are listed (table 1). All of them have also produced furniture without this special marquetry. But, for example, Fortner also used coloured horn for the marquetry on his furniture.

Wack Company, Kassel

Two secretaries (inv. no. St. C. Gl. 772 a + b) in the possession of the Museumslandschaft Hessen Kassel were manufactured by the Wack company and dated 1842. They are signed – a little hidden however – on the inside of the furniture, and inlaid as a mirror image (figure 2). Ludwig Wack founded his company in Kassel in 1831, and as early as eight years later it had already grown significantly. On the occasion of the industrial exhibition that same year, Wack displayed an extensive range of products consisting of little objects such as combs and walking sticks, to name but a few. He also offered ready-made veneer fittings for secretaries, work

Figure 1 Armchair, 1844, Franz Xaver Fortner, Munich. Schloss Stolzenfels in Koblenz. Photo: Generaldirektion Kulturelles Erbe Rheinland-Pfalz, Jürgen Hocker.

Figure 2 Signature Ludwig Wack in the secretary: L. WACK & COMP: CASSEL. 1842.
Special coloured inlays on furniture in the mid-nineteenth century. Imitation of lacquer, ivory or horn? For the 1842 industrial exhibition at Kassel, Wack only provided a rosewood drop-front secretary inlaid with metal and mother-of-pearl in various colours. Maybe it is one of the two which are still in the possession of the Museumslandschaft Hessen Kassel?

It is known from letters and credit applications that Wack made veneers from wood, bone and ivory. A ‘coloured wood cutting machine’ in his possession is mentioned. Later, the Wack Company, taken over by his sons, produced cigar boxes and parquet floors, until its liquidation in 1903.

The two secretaries are constructed like secrétaires à abattant (figure 3). There is a drawer in the upper part, a drop front in the middle, and behind the two doors in the lower part there are drawers, so-called English drawers. Both drop-front secretaries are veneered with rosewood and metal marquetry on the outsides. Behind the drop front writing surface there is an open middle section with a mirrored rear panel (figure 4). The five drawers on each side as well as the two doors can be opened by using different buttons, wooden strips, and levers. In the

<table>
<thead>
<tr>
<th>Cabinetmaker/company, city</th>
<th>Furniture</th>
<th>Year</th>
<th>Current location</th>
<th>Coloured inlays</th>
<th>Bibliography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brothers Barth: Adam (1815–82) and Stephan (1809–84) Barth, Würzburg</td>
<td>writing table</td>
<td>1842</td>
<td>Mainfränkisches Museum Würzburg</td>
<td>red, blue, white, green</td>
<td>Baron Döry 1974; Bahns 1987, fig. 3; van Wüllen 2011</td>
</tr>
<tr>
<td>small box</td>
<td>1850</td>
<td>Mainfränkisches Museum Würzburg</td>
<td>violet, blue, red, green, pink, orange and yellow</td>
<td>van Wüllen 2011, 51</td>
<td></td>
</tr>
<tr>
<td>Adam Neppenbacher (1801–1868), Würzburg</td>
<td>work table</td>
<td>1843</td>
<td>Mainfränkisches Museum Würzburg</td>
<td>green, violet, red, blue, light blue and dark pink</td>
<td>Trensche 1973, 308–309; Bahns 1987, fig. 38</td>
</tr>
<tr>
<td>Franz Xaver Fortner (1798–1877), Munich</td>
<td>grand table</td>
<td>1842</td>
<td>Schloss Stolzenfels in Koblenz</td>
<td>red</td>
<td>Himmelheber 1973, 142, fig. 671, 672; van Wüllen 2011, 44, 142</td>
</tr>
<tr>
<td>grand table (looks like the contre partie of the Stolzenfels table)</td>
<td>1843</td>
<td></td>
<td>was offered at Sotheby’s in 1986</td>
<td>red, blue and green</td>
<td>Bahns, 1987, 10, 16, 44, fig. 1 frontispiece</td>
</tr>
<tr>
<td>Armchair (figure 1)</td>
<td>1844</td>
<td>Schloss Stolzenfels in Koblenz</td>
<td>red, blue, pink[4]</td>
<td>Himmelheber 1973, 142, fig. 755; van Wüllen 2011, 44, 144</td>
<td></td>
</tr>
<tr>
<td>Carl Friedrich Heinrich Plambeck (1814–1879), Hamburg</td>
<td>grand table</td>
<td>1851</td>
<td>Museum für Kunst und Gewerbe in Hamburg</td>
<td>White, yellow, red, purple, blue and green</td>
<td>Himmelheber 1973, 163, fig. 599; Jeding et al. 1977, 13–16; Bahns 1987, 97–98, fig. 60; van Wüllen 2011, 47–49, 145–147</td>
</tr>
<tr>
<td>grand table</td>
<td>1848</td>
<td>Schloss Schwerin</td>
<td>Blue, green, red, purple</td>
<td>Möller 2013, p. 312–316, fig. 219</td>
<td></td>
</tr>
<tr>
<td>Ludwig Wack (1798–1875) and Company, Kassel</td>
<td>secretary</td>
<td>1842</td>
<td>Museumslandschaft Hessen Kassel</td>
<td>White</td>
<td>Weinberger, 1994, 31–34, fig. 572</td>
</tr>
<tr>
<td>secretary</td>
<td>1842</td>
<td></td>
<td></td>
<td></td>
<td>Weinberger, 1994, 71–73, fig. 621</td>
</tr>
<tr>
<td>Unknown Producer, Lübeck or Hamburg</td>
<td>writing desk</td>
<td>1850–1860</td>
<td>St. Annen Museum in Lübeck</td>
<td>white, blue, purple, yellow, green, red</td>
<td>Himmelheber 1973, 574; Jeding 1977, fig. 14; Bahns 1987, fig. 36; van Wüllen 2011, 50–51, 148–149</td>
</tr>
<tr>
<td>writing desk</td>
<td>1840–1850</td>
<td>St. Annen Museum in Lübeck</td>
<td>white, blue, tortoiseshell-coloured</td>
<td>van Wüllen 2011, 46–47, 144–145</td>
<td></td>
</tr>
<tr>
<td>work table</td>
<td>1850–1860</td>
<td>St. Annen Museum in Lübeck</td>
<td>white, blue, purple, yellow, green</td>
<td>van Wüllen 2011, 49–50, 147–148</td>
<td></td>
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Table 1: List of cabinetmakers and furniture
Figures 3a, b  Drop-front secretaries, both 1842, Wack Company, Kassel. Museumslandschaft Hessen Kassel.
Figure 3a  Inv. no. St. C. Gl. 772a (right).
Figure 3b  Inv. no. St. C. Gl. 772b (left).

Figure 4a, b  Secretaries, Wack: behind the drop front writing surface.
Figure 4a  Inv. no. St. C. Gl. 772a (right).
Figure 4b  Inv. no. St. C. Gl. 772b (left).

Figure 5  Secretary, Wack, inv. no. St. C. Gl. 772a: Detail of the coloured inlays in yellow, rose, blue, red, and green.
interior there are no visible locking mechanisms such as keyholes as there are on the outsides of the drop front and doors.

The sections behind the drop front are decorated with these special materials: one of the secretaries has white inlays, in imitation of ivory. The other one, an example of oriental historicism, features not only mother-of-pearl, wood veneer and metal, but also inlays in yellow, rose, blue, red, white and green (figure 5).

**Examination and analysis**

We began by researching the literature on the prominent German objects, in order to find information on what the materials consisted of. Unfortunately, there were not many clues. In reports contemporary with production of the objects it is unfortunately not mentioned. In later literature it is usually referred to as lacquer, matter or paste, or labelled as horn, ivory or mother-of-pearl. Only the son of an employee of the Barth Company in Würzburg, who produced the writing table for the Grand Duke, indicates around 1924 the use of ‘artificial, coloured veneers’.

The examination of the Kassel objects and their comparative pieces led to the exclusion of naturally grown materials such as ivory or mother-of-pearl as they had different surface textures and damage patterns. Closer scrutiny, under magnification, showed further details of the Kassel objects. It became apparent, as the red inlay shows, that this is a pigmented material (figure 6). Furthermore, there are saw cuts discernible on the edges (figure 7). Therefore, it can be concluded that the joints surrounding the single colours were not created by the drying of a material that had been applied wet, but by a saw cut of 0.13 mm (0.0051 inches) to 0.3 mm (0.012 inches) width (figure 8). These saw cuts are also to be found on all other comparative pieces that were examined. Little drill holes and saw cuts originating from those holes point to the cutting of the material as a veneer packet (figure 9).

The veneer itself has a thickness of 0.5 mm (0.019 inches). The chipped edges of the engravings reveal the brittle character of the material. The fact that the engraving extends into the filling agent of the saw cut points to a multi-stage finishing of the marquetry (figure 11). All these hints lead to the conclusion that the use of a viscous liquid material such as a lacquer paste can be excluded.

At the same time, the material was examined by means of various analytical techniques. These

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*Figure 6* Secretary, Wack, inv. no. St. C. Gl. 772a: Detail of the red inlay.

*Figure 7* Secretary, Wack, inv. no. St. C. Gl. 772a: Saw cuts on frame of the inner door.

*Figure 8* Secretary, Wack, inv. no. St. C. Gl. 772a: Detail of a kerf, saw blade diameter 0.13 mm.

*Figure 9* Secretary, Wack, inv. no. St. C. Gl. 772a: Borehole within the marquetry.
showed that the binder was not, as hypothesised in the literature, an oil or a resin, but a protein. The spectrums of the FTIR (fourier transform infrared spectroscopy) analysis showing the greatest congruence with animal glue. The restorers examining the coloured inlays of the armchair by Franz Xaver Fortner came to the same conclusion. To fill the joints and engravings, a gum copal-oil varnish mixed with vine black was used. White lead sulphate was used as white pigment. Indications of alum were found. VIS-Spectroscopy, a non-destructive analysis, led to the conclusion that Prussian blue, vermilion, cochineal, green copper pigments and chrome yellow or cadmium yellow were used for the colouration.
Reconstruction

Equipped with these observations and analytical results a search to find instructions and a formula for making such material was started. A recipe ‘for the fabrication of artificial ivory veneers’ in the reports of the Polytechnischer Verein für das Königreich Bayern (Polytechnic Society for the Kingdom of Bavaria), dating from 1853, as well as a formula for glue-veneers from the year 1857 were found. In both recipes a mixture of animal glue and alum is blended with the chosen pigment. This mixture is poured onto a glass top and dried. The sheets thus obtained are then treated again with an alum solution, and dried once more.

What sounds quite simple in the theoretic description led to some difficulties during the practical execution. Referring to the recipes, and after several experiments, a 10% solution of animal glue (one part bone to four parts hide glue) with 2.5% by weight of alum was used. By the addition of alum the sensitivity of the dried sheets to moisture was reduced, so further processing would be much easier. The dried sheets, no matter whether dried at a normal, slow or at a fast pace, were always very warped (figure 13). The ensuing alum bath only led to a short-term improvement. In addition, the sheets were quite brittle; even if a smooth surface could have been achieved, processing them in a veneer packet would not have been possible. Numerous attempts and further research of related recipes led to slight modifications such as warming the glass plates, adding tiny amounts of linseed oil (less than 2% by weight) and omitting the alum bath. This finally led to a viable result (figure 14). This way of proceeding led to smooth, even, and slightly elastic veneers that could be used for further processing and also stand up to comparison, optically, with the original material.

After producing some sheets of the right thickness to be cut in a packet, the reconstruction of the marquetry was started. In this way it was possible to determine if the processing, as it had been imagined in the research, was actually feasible. But replicating the technique also had its own pitfalls, which were to be encountered particularly in sawing the veneer packets with the very fine saw blades. As glue in veneer packets damages the saw blades, glue-veneers probably had negative effects on their durability.

The comment of the above-mentioned son of an employee of the Barth company in Würzburg, who stated that his father had used 144 dozen saw blades for the manufacturing of a writing table, was quickly put into perspective by our use of 50 saw blades, 0.16 mm (0.063 inches) thick, for two little test sheets. In all other aspects, however, the veneers proved to be very stable and could be finished in detail. The engravings could be done with a pointed needle. When comparing the surfaces they each showed a similar composition. Filling the joints with gum copal-oil varnish and subsequently applying the final sanding touch also confirmed the feasibility of this process (figure 15).

Conclusion

Determining the composition of the coloured...
veneers is important both for understanding the material’s behaviour and for potential restoration. As test material was limited, the combination of analysis and experiments proved a good method for reconstructing the coloured veneers. The proof that this material can be produced relatively easily may explain the prevalence of coloured inlays throughout Germany. Further research and finding more comparative pieces are nonetheless still necessary.

Did these coloured inlays serve as imitation material, or didn’t they? As far as the white veneer is concerned one could easily think of it as a substitute for bone or ivory. However, when it comes to the coloured variants, it is not clear whether they served as imitation for valuable materials like colourfully underlaid horn or coloured ivory. Or maybe it had been intended to be a durable variant of the colourful marquetry wood, such as is found on Roentgen furniture. At the time of the production of these pieces of furniture, in the mid-nineteenth century, the coloured inlays of grand ornate furniture may not have completely faded, but the problem of the effect of light changing bright colours to various shades of brown was surely known. Maybe this was an attempt at countering this problem in these times that were so rich in new materials and inventions? The success is proven in the vibrancy of the colours, still so well-preserved today.

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Special coloured inlays on furniture in the mid-nineteenth century. Imitation of lacquer, ivory or horn?

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Notes


7 Gewerbeverein 1842, 21 after van Wüllen 2011, p. 13.

8 HSTAM Best. 18 No. 1107 after van Wüllen 2011, pp. 15–16.


11 Making and evaluations of the FTIR spectra kindly done by Prof. Dr. Elisabeth Jägers, FH Cologne.

12 Measurements and evaluations of the spectra kindly done by Dr. Doris Oltrogge, FH Cologne.

13 Ultramarin was analysed as pigment for the blue inlays of the Fortner armchair, friendly written notice from Jutta Waschke, Generaldirektion Kulturrelles Erbe Rheinland-Pfalz, 27-9-2016.
A red dye based on Anthrachinon was analysed for the Fortner armchair, friendly written notice from Jutta Waschke, Generaldirektion Kulturelles Erbe Rheinland-Pfalz, 27-9-2016.

Analysis: Mikroanalytisches Labor Dr. Jägers in Bornheim.


Döry 1974, p. 126.

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• All photos were taken by Stefanie van Wüllen unless otherwise stated.
A window with different views. The conservation of the ivory windows of Sundari Chowk at the royal palace in Patan, Nepal

Regina Anna Friedl, Tatjana Bayerova, Gabriela Krist

Introduction

Since 2010, the Institute of Conservation of the University of Applied Arts, Vienna, has been involved in cooperative conservation campaigns in Patan, Nepal. So far there have been nine work missions organised during the summers of each year and they have intensified since 2015, as a reaction to the earthquake in April and May 2015. Patan’s Durbar Square and the royal palace complex are UNESCO World Heritage Sites. Since 1979, seven monuments and ensembles in the Kathmandu Valley have been registered on the World Heritage List of UNESCO.

The ivory window ensemble is located at the royal palace in Patan (figure 1), which is also named Lalitpur - the beautiful city. The town, which is the oldest in the Kathmandu Valley, is famous for its beauty and for fine crafts like woodcarving and metal casting. These artworks are visible throughout the city, at the palace and the temples as well as at other buildings around the Durbar Square. The great architecture is a testament to the Malla rulers from the thirteenth to the eighteenth century AD. The royal palace, which was once the court of the Malla Kings, consists of three different courtyards: the Sundari Chowk, the Mul Chowk and the Manikeshw Narayan Chowk. The Ivory Window Ensemble is an integral part of the facade of the Sundari Chowk facing onto Durbar Square and it is the main decoration of the whole building. The Sundari Chowk was built by order of King Siddhi Narasimha Malla in the year 1627 and was the residence of his family.

Object description

The ivory window ensemble is located above the main entrance of the royal palace and overhangs the entrance at an inclined angle from the wall facade (figure 2). The window consists of three openings that are framed by a wooden construction decorated with carved ornaments. The wooden window construction is held together by a plug-in system and is composed of a variety of materials such as ivory, wood, metal and textile. The ivory from the window ensemble was identified as the being from the Asian elephant (Elephas maximus indicus).

The central window is made of fire-gilded repoussé copper and is flanked by two embellished ivory windows. Each of these measure 150 x 150 cm and both windows have almost the same design in composition and decoration.

Figure 1 Façade of the Sundari Chowk, facing the Durbar Square.
The embellishments, floral motifs and leaves as well as ornamental bands and pillars are made up of carved ivory. The window construction consists of wood and provides support for the ivory carvings which are fixed with iron nails to the support. In addition, some fine floral carvings are decorated with metal leaf beneath. The openings are flanked by wooden pillars which show textile wrapping under the ivory casing. The textile was probably used as a buffer against moisture. All surfaces of the windows are covered with a white secondary coating which has probably been applied as a protection against poor environmental conditions and also for aesthetic reasons.

History and comparative samples
The window ensemble represents a very rare and precious example of Nepalese craftsmanship and it is the only one of its kind in the whole palace complex. The decorative motifs such as dragons and winged, angel-like figures, identified on the windows, suggest a probable date of about 1730. A similar decorated ivory window ensemble can be found in Kathmandu city, where it is built into the corner of the Hanuman Dhoka Palace’s facade. It was constructed for King Bhaskar Malla (1722-1734). It contains five apertures, the middle one decorated with gilded copper repoussé and the left and the right windows with ivory. The carvings and embellishments at the Hanuman Dhoka Palace in Kathmandu are not as rich and delicate as the decorations of the windows in Patan.

The oldest window in this style was found in Bhaktapur at the Simhadvaradhvaka of Bhupatindra’s Palace and is possibly dated to the end of the seventeenth century. Unfortunately, this window is no longer extant since it was destroyed by an earthquake in 1934.
Ivory - the material
Throughout the history of mankind ivory has been a very important and precious material. It has been used since the Palaeolithic age, about 100,000 years BC, mainly for sculptures and figures. Some of the oldest finds are small women and animal figures dating back to 30,000 BC. The name ivory is only used for elephant and mammoth tusks, while mammoth ivory is also known as fossil ivory. A differentiation can be made between the tusks of the African and the Asian elephant. The tusks of the African elephant (Elephas africanus) are bigger than those of its Asiatic counterpart. The African elephant's tusks are around 2–2.25 m long and are approximately 70–90 kilograms in weight. This kind of ivory is yellowish in colour, slightly transparent and its surface contains a characteristic patterning. African ivory is also called 'green ivory' because of its slightly greenish character. Being physically harder and more brittle than the ivory of the Asian elephants, it also cracks more easily. Since African ivory has the highest grade for hardness and thickness, it is very suitable for burnishing.

In the case of the Asian elephants (Elephas maximus), only male animals grow tusks, measuring up to 1–1.5 m in length and weighing about 25–30 kilograms. Asian ivory has a white appearance, is more opaque and it yellows faster than its African counterpart. Since Asian ivory is a softer material containing a finer patterning, it is more workable in the sense of being engraved or cut, but cannot be polished as well as African ivory.

Differences in colour and structure of ivory are dependent on many factors: elephant species, the animals' diet, age and breed, as well as the climate the animal has lived in. The hardness of ivory depends on various factors, such as the distribution of minerals in the diet and climatic conditions. The tusk is harder when the climate is warmer and moister. The point of the tusk is the hardest part. The tusk is harder when the climate is warmer and moister. The point of the tusk is the hardest part. The primary component of the tusk is dentine. Dentine is a hard, calcareous tissue of whitish to yellowish appearance consisting of inorganic and organic components as well as water. The organic part is mainly based on protein collagen; 80% of the inorganic part consists of hydroxylapatite, calcium phosphate and the remaining 20% is composed of magnesium phosphate, calcium carbonate and fluorides. The water content of fresh ivory is about 20 to 25% while in dried ivory this decreases to between 13 and 15%. One of the main optical characteristics of ivory is the unique grain patterns known as Schreger Lines and Lines of Retzius. These lines can help to identify if a piece is elephant or mammoth ivory.

Due to its chemical composition, namely the high portion of collagen, fresh ivory is a very hard and elastic material. During its ageing, the amount of collagen reduces and the ivory becomes brittle. Ivory is a highly hygroscopic material. To establish equilibrium between the moisture content in the ivory and the moisture in its environment ivory swells and shrinks with fluctuations in the relative humidity. As an organic material, it naturally undergoes ageing and deterioration processes. During drying and degradation of the collagen, the distinctive ivory pattern is released due to the decomposition of the material. Yellowing is also a kind of a natural ageing process, which is conditioned by chemical transformation of the collagen. This is visible in colour changes and the loss of flexibility. The main factors influencing the decay of ivory are relative humidity, temperature and UV light.

Condition of the window ensemble
The overall condition of the ivory windows could be regarded as very poor, leaving the ensemble in jeopardy. The pinewood frames showed serious wet-rot and pest damage, and several wooden elements had lost their structural integrity. The carved timbers as well as the latticework were frequently broken or completely missing. The edges of beams were badly rotted and very brittle, some areas showed deep, long cracks, which was a sign of the wood's desiccation. The wooden surfaces were covered with a white secondary coating, probably executed to imitate the lost ivory carvings. Thick layers of dust covered the whole surface of the windows, especially in hollow spaces. The layers of dirt adhered strongly to the wooden surface.

The ivory was also in very bad condition. There was only 20% to 30% of the original amount of ivory left and these remnants were badly degraded. Several factors causing decay could be identified: the overall presence of dust and dirt, the white coating, the loss of overall stability due to the fragile and porous surface, leading to a high number of missing parts (figures 3 and 4).

Ivory is unsuitable for exterior use, especially in a hot and humid climate. Extreme fluctuations of relative humidity and temperature force the material to expand and contract causing cracking and...
splitting. Another reason for the deterioration and loss of the ivory were the iron nails used for fixing the embellishments to the wooden support. Iron has a different coefficient of thermal expansion than ivory, causing cracking and splitting in lengthways.  

The ivory’s surfaces were covered with layers of dust and dirt, which penetrated deep into the ivory matrix and intermediate spaces. The fragile carved ivory pieces were, as already mentioned, covered with a white coating which had probably been applied as a protection against environmental impact. It could also have been applied to cover dust and dirt on the surface of the ivory carvings (figures 5 and 6).

To identify the white coating analyses were carried out using optical microscopy and scanning electron microscopy with energy dispersive X-rays. The examination showed that the coating was composed of four different white paint layers (figure 7). In the bottom paint layer the pigment zinc-white was detected. This finding confirmed the assumption that the white coating is a secondary addition which can be dated, at the earliest, to the second half of the nineteenth century. Due to the presence of the coating the fine ivory carvings were no longer visible and, moreover, the coating penetrated very deep into the ivory matrix.

The overall condition of the fire-gilded metal repoussé window was better. About 20% of metal elements were missing and the metal surfaces were covered by hard and dense dirt layers (figure 8). There were also several damages caused by mechanical forces that have led to major deformations in some of the metal parts. In addition some cracks were visible and some metal parts bent out of shape.

Figure 5 Dust and dirt on the surface of the ivory carvings.

Figure 6 White coating on the ivory carvings.

Figure 7 Cross-section of the white coating, reflected-light microscopy and UV light.

Figure 8 Condition of the central metal window.
Aim and concept of the conservation treatment
The main aim of the conservation treatment is to preserve and protect the original substance of all three windows as an ensemble. This artwork is a very rare and precious item of highly sophisticated Nepalese craftsmanship and is of a great value for the Nepali community. Due to its poor condition a conservation treatment of the whole window ensemble had to be recommended.

The methodology for the conservation of this precious item was twofold: Firstly, the conservation and consolidation of the original ensemble and prevention of any further losses. It was also important to consider the condition of all three windows in order to achieve a unified and homogenous appearance of the ensemble after the conservation. Since it was decided not to reinstall the ivory windows into their original place on the facade, the making of replicas was proposed, with the original ivory windows being exhibited, after conservation, at the Patan museum, under stable climatic conditions. The conserved central metal window will be reinstalled on the facade together with the replica ivory windows.

Conservation treatments and reconstruction
The window ensemble was dismantled in spring 2013 and prepared for further conservation and preservation. The first step was to disassemble the construction into its individual parts for further treatments. Where it was possible, ivory carvings as well as metal applications were detached from the wooden support.

The wooden support
After the dismantling, all wooden beams were further disassembled for easier handling. Their surfaces were cleaned with rotating horse and goat hair brushes. Some parts were wet cleaned to remove the thick and hard layer of dirt. The white coating was removed mechanically with scalps and glass fibre brushes as well as soft brushes. However, the white coating had to be left on some of the degraded parts. To disguise the white coating, these areas were retouched with water colours. The fragile and rotted wood was consolidated with 10% Paraloid B72 in acetone. After the consolidation the wooden surface was gently treated with acetone to remove the remaining acrylic resin from the surface. The broken wooden parts were glued with a PVA dispersion. Missing parts of the wooden frame were reconstructed by craftsmen from the local monument preservation office Kathmandu Valley Preservation Trust.

The metal window
All metal parts were dismantled from the wooden support for further treatment. Loose dust and dirt was removed with soft brushes. Afterwards, all the metal parts were cleaned with water and mild detergent (Pril). The hard, thick layer of grime was eliminated using a chelating agent which was applied with soft brushes, hard crusts were removed mechanically. After this treatment, the metal elements were rinsed with water to remove any remnants of the chelating agent. Some sensitive surfaces of the gilded repoussé copper were partly cleaned using a low frequency laser. The deformed metal parts were reformed into their original shape by a local coppersmith with rubber and skin hammers and placed back onto the wooden frame. The missing parts of the copper repoussé work were reproduced by local craftsmen. To harmonise the appearance of the new metal elements with the preserved original surfaces, new gilding of the overall surface was necessary. An adhesive based on linseed oil (mixture) was applied on the surface and Dukaten Doppelgold gold leaf was used for the gilding. Finally, cotton buds soaked in acetone were gently wiped over the surface to create a uniform appearance of the gilded metal (figure 9).

Conservation of the original ivory windows
Some parts of the ivory carvings were dismantled from the wooden beams. Where possible, the iron nails were removed from the carvings. The dismantled carvings were numbered and fixed on Ethafoam plates for further treatment. Very fragile elements were left on the wooden beams. Dust and dirt were removed from the surface with fine, soft brushes. The white coating was removed in...
two steps; mechanically with glass fibre brushes and scalpels, followed by a treatment with a laser. The laser cleaning proved to be very gentle to the porous and fragile surface of the ivory: thick layers of dust and dirt as well as the white coating could be removed easily without damaging the surface of the carvings (figures 10 and 11). The consolidation of fragile and degraded ivory parts was carried out with 10% Paraloid B72 in acetone. The consolidant was applied with a soft brush. Broken ivory parts were joined with 30% Paraloid B72 in acetone. All the treated ivory elements were put back into their original place using brass nails. The loose textile wrapping on the pillars was consolidated with 5% Klucel E in ethanol before the ivory carvings were applied. For safety and easier handling, the wooden parts of the ivory windows were pegged together and fixed on a doubled plywood-board (figure 12).

Reconstruction of the ivory windows

It was suggested by the Kathmandu Valley Preservation Trust that the reconstruction of the precious carvings be done using genuine ivory. Due to ethical and legal reasons, this could not be an option. Several materials for making replicas were selected. Their handling properties were studied and their resistance to environmental conditions was tested by their exposure to UV light. Because ivory has always been a very precious material a variety of substitute materials and historical recipes for its imitation are available. Most of the historical recipes suggest the use of animal glue and proteins, which is a breeding ground for microbiological growth and for this reason these materials have been excluded. Also, the use of gypsum is not advisable due to its sensitivity to water or humidity and therefore making it unacceptable for exterior use.

There are also several synthetic materials that were used in the nineteenth century to imitate ivory. Probably the most popular substitute was celluloid, invented by J.W. Hyatt in 1863. Celluloid, the first thermoplastic created from cellulose nitrate and camphor, deteriorates quite rapidly: typical signs of its degradation are cracks, crystalline precipitate, fragility, discolouration, shape deformation and a fluid film on the surface.

Ivorina is an early semisynthetic polymer produced from casein. Its characteristic colour striation could give the impression of the lines of Retzius found in ivory.

Another early plastic, bakelite, also named urea bakelite, is a urea formaldehyde resin. For the imitation of ivory it was manufactured into a substance
with a high amount of fillers and pigments, such as the mineral barite. Polyvinyl chloride and polystyrene, both initially synthesised after 1930, were also popular surrogate materials used instead of ivory.

Another substitute for ivory is Elforyn, a high-grade mineral plastic developed and made in Germany. According to the manufacturer Elforyn is a mixture of different minerals, compounded with a light stable resin component that ensures its permanent colour stability. Duhme examined this material in more detail with FTIR spectroscopy. Results show that this material is a kind of polyamide containing different fillers.

The most successful ivory imitations today are made of epoxy resins. Epoxy resins are synthetic reactive prepolymers and polymers which contain epoxide groups. In general, uncured epoxy resins are not mechanically and chemically resistant, therefore their curing is necessary. The curing means the reaction of the linear epoxy resin with suitable curatives, most commonly hardeners, to form three-dimensional highly cross-linked thermoset products with exceptional toughness, adhesion, chemical and ageing resistance. Due to these excellent properties as well as only minimal shrinkage during the hardening process epoxy resins are widely used for different purposes in the conservation of artworks.

Despite their overall stability there are epoxy resins with a weak light stability turning yellow during ageing. For the imitation of ivory light-stable epoxy resins with various fillers and pigments are recommended. The resin can be cast in different moulds. Since the reconstruction with an epoxy resin should be carried out in a reversible way, a layer of Paraloid B72 between the ivory and the cast resin can be used. In case of yellowing the replica can be easily replaced by a new one in the future.

Test series
For the testing of the potential imitation materials, bovine bone, pineapple wood, Elforyn and epoxy resins with different fillers were chosen. All the materials were investigated regarding their workability for carving and they underwent the artificial ageing under UV light. Their stability, regarding the environmental conditions in Nepal and their long-term ageing characteristics, were also examined.

Bone
Bone is chemically similar to ivory, but due to its tubular network it has a relatively rough texture.
To use bones for restoration and as reconstruction material they must first be boiled, dried and be free from marrow. After a drying period of about two weeks, fine plates were cut from boiled bone and prepared for carving. Carvings were made using a fine saw, scalpels and other carving tools. As bone is a very hard material, it was not easy to saw and carve it. Nevertheless, the surface of a carved bone plate was very similar to the carved ivory from the windows (figure 13).

**Wood**

As there are excellent local craftsmen in Nepal, especially local carvers, the possibility of ivory reconstruction using wood also had to be taken into consideration. From various types of wood, pear wood was selected for testing since it is straight grained and, therefore, suitable for carving. A plate of pear wood was carved and painted with white acrylic paint (figure 14), but its surface appearance did not match that of ivory. Wood grain was visible through the white paint and disturbed the appearance of the surface.

**Elforyn**

Elforyn is available in different shapes and sizes. For the floral patterns Elforyn panels with a size of 3 x 50 x 305 mm and 5 x 50 x 305 mm were used. Since Elforyn is a soft material suitable for carving, it was easy to saw and to cut it with a scalpel. For the test series, different floral patterns were produced. The appearance of the floral replicas and the workability of Elforyn were good (figure 15), making this material a good choice for using for the reconstruction of the ivory windows.

**Epoxy resin with different fillers**

Mixtures of epoxy resin with different fillers such as bone powder, marble powder, glass microballoons and white pigments were produced and moulded into panels. Despite the presence of small air bubbles in the cured panels (figure 16), they were suitable for the carving of patterns used for the preparation of casting moulds. The next step was the preparation of silicone casting moulds from the carved epoxy resin patterns. These were fixed to a wood block with fine nails and a board was fixed around them (figure 17). It was very important that this form board was well sealed, so that the silicone could not leak out. The degassed silicone was then carefully filled into the form and allowed to dry for about 24 hours. The silicone moulds were ready for making of final replicas in epoxy resin, but this step turned out to be problematic. Due to the presence of fillers like marble powder and bone powder the mould could not be degassed well enough, resulting in a cast with several air bubbles. Therefore, the epoxy resin without any filler, coloured only with white pigment and tinted with a small amount of ochre pigment, was used. The filled moulds had to be degassed for about two hours, and the final casts contained hardly any bubbles (figure 18). To find the best epoxy resin for the reconstruction of the ivory elements test series were carried out. Three different epoxy resins were artificially aged in a UV-chamber for six weeks. The results showed that colour changes occurred within the first two weeks. After week four no more yellowing was observable. The epoxy resin HXTAL NYL showed only slight yellowing after six weeks of exposure. Despite the outstanding UV stability of the HXTAL NYL epoxy resin it could not be used in situ due to its long curing time of up to seven days. Therefore, an epoxy resin Epotek 301-2 with only one day hardening time was chosen, despite its UV stability not being as good as that of the HXTAL NYL resin. Epotek 301-2 pigmented with zinc white and yellow ochre was selected as the best option.

**Conclusion**

These test series can be considered as preliminary studies for the reconstruction of the ivory elements. The reconstruction of the windows and their ivory décor was carried out by colleagues of the Institute of Conservation, University of Applied Arts Vienna, during the conservation campaigns between 2014 and 2016. The replicas were reinstalled at the façade of Sundari Chowk in Summer 2016. The central metal window has been put back to its former position on the palace façade between the reconstructions.

The original ivory windows were fully conserved and are exhibited at the Patan Museum under stable climatic conditions. Recommendations were made for their storage and exhibition, with regard to the climatic conditions in Nepal. This new stable environment will help to protect the original ivory windows from further decay which was caused by the fluctuating climate, sunlight and air pollution of its former position on the façade.

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A window with different views. The conservation of the ivory windows of Sundari Chowk at the royal palace in Patan, Nepal.

Notes


2 UNESCO, Master Plan for the Conservation of the Cultural Heritage in the Kathmandu Valley, Paris 1981, p. 9; In 1979, the World Heritage Committee approved Nepal’s application to place seven sites in the Kathmandu Valley on the World Heritage List. The seven sites that have been chosen are representative of all aspects of Nepal’s Cultural Heritage, its architecture, art and religion. The Seven Monuments of the Kathmandu Valley are: The Kathmandu Durbar Square, the Patan Durbar Square, the Bhaktapur Durbar Square, the Buddhist Stupa of Swayambhunath and Boddhanath, the Hindu temple complex of Changu Narayan and Pashupatinath.


5 Amatya 2007, p. 86.

6 Korn, W., The traditional architecture of the Kathmandu Valley, Kathmandu 2007, p. 75.


8 The analysis of ivory was carried out by Dr. Arun Banerjee from the International Centre of Ivory Studies (INCENTIVS) at Mainz University (Germany). Kathmandu Valley Preservation Trust, ‘Restoration of the Ivory Window of Sundari Chowk. Project Application’, November 2012, p. 9.


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18 Stone, T., ‘Care of Ivory, Bone, Horn, and Antler’, in: CCI Notes 6/1, Canadian Conservation Institute, Canada 2010, p. 1.


22 Freund 1999, p. 3.

23 Freund 1999, p. 16.


26 Analysis by SEM-EDX were carried out by Prof. Dipl.-Ing. Rudolf Erlach, Archæometry Department, Institute for Art and Technology, University of Applied Arts Vienna.

27 Zinc white was commercially available since the middle of the nineteenth century.

28 A glass fibre transmitted Nd-YAG laser, Eos 1000 QLS, from El.En. Company (Italy) was used.


31 http://www.rohm.ch/Lexikon/l_elfenbein.html (access 22.06.2013).

32 http://www.elforyn.de/ (access 22.06.2013).

33 Duhme 2008, pp. 113-114.


36 Freund 1999, p. 76.


39 H. Schmincke & Co. GmbH & Co. KG.

40 Purchased by Bachman Kunststoff Technologien GmbH.

41 EPO-TEK 301-2 purchased by Kremer Pigmente.

42 Wacker Silicones, Elastosil 4470, purchased by Kurt & Wolf CO KG.
44 ARALDIT 2020, Epotek 301-2, HXTAL NYL.
45 HERA EUS Typ 6030, Heroeus Instruments
Let’s pretend. Conservation of an experimental tortoiseshell imitation

Thijs Janssen

Abstract
Tortoiseshell has been used as a decorative material in the arts since the beginning of written history. It has always been scarce and is therefore often imitated. Het Loo Palace in Apeldoorn, the Netherlands, has a cabinet from the 1840s in its collection with a rare imitation finish: it is not horn, nor is it one of the semi-synthetic plastics that were developed in the nineteenth century. Over time the finish had become dull, cracked, distorted and fragments had chipped off. In order to develop an appropriate treatment method, its composition and material properties had to be studied. It proved to be an experimental material made out of animal glue.

Introduction
Het Loo Palace was a residence of the Dutch royal family from the middle of the seventeenth century until the death of Queen Wilhelmina in 1962. In the 1980s it was turned into a museum of the Orange-Nassau family. One of the most extraordinary pieces from the collection is a silverware cabinet that is likely to have been bought by King William II and that was brought to Het Loo after his death by his son King William III.¹ The cabinet was made in the 1840s in revival style, combining elements of the Gothic and Baroque periods, most noticeable in the use of pinnacles, pierced columns and ripple mouldings (figure 1). The upper part of the cabinet is fitted with plate-glass windows with red silk curtains and mirror glass on the inside. The lower part has mirror glass on the front and sides. The imitation tortoiseshell is applied to the top gallery (now partly missing), the front, the sides and top of the lower part.

The cabinet is ascribed to Frederik Koster, a cabinetmaker from Utrecht, the Netherlands. It is a showpiece demonstrating the skills of a craftsman. It is known from an inventory that King William II bought a ‘silverware cabinet, decorated with tortoiseshell and plate-glass’ at an exhibition in 1847.² It was in this period that Koster acquired the title ‘Royal Purveyor of tortoiseshell furniture’. Only a

Figure 1  The silverware cabinet before treatment. Photo: Het Loo Palace.

Figure 2  The pattern of craquelure.
few cabinetmakers in the Netherlands were able to work with this material at this time. 3 Paul Rem, curator of furniture at Het Loo Palace, further suggests that Koster used the imitation tortoiseshell to demonstrate his knowledge of the latest materials, where he could have also used horn, a traditional tortoiseshell imitation material. 4

Condition
The imitation tortoiseshell is in a bad condition. It is dull, cracked, distorted, and fragments have chipped off (figure 2). Moreover, the material is brittle and therefore extremely vulnerable in the distorted areas. The damage is caused by the interplay of the material properties of the imitation material, the construction of the cabinet, and the conditions of storage. The imitation material is sensitive to fluctuations in relative humidity: it expands and contracts. It is glued to a wooden substrate that is also water-sensitive, but that expands and contracts at a different rate and in a different direction. The imitation is thus restricted in its dimensional change, which causes tension and, consequently, cracking.

The most common pattern of craquelure starts at the edges. The finest cracks are visible to the eye only as dullness, but as the material further deteriorates and repeatedly goes through cycles of shrinkage and expansion, small cracks appear. These are visible along all the edges and can, at their worst, run through the whole surface to the opposite edge. This process is accelerated by moisture acting on the increased surface area of the distorted areas. These areas can chip off easily, especially when brittle, making the substrate visible. In areas where the substrate cannot expand and contract because of construction, there is hardly any damage visible.

Another pattern of craquelure is the result of a conservation treatment in the 1990s. In 1993, the Cultural Heritage Agency of the Netherlands performed FTIR analysis on a sample and stated that it was composed of casein, starch, and a natural resin. It was ‘possibly casein formaldehyde’, but the research was ‘not conclusive’. 5 At the time, the conservation of (semi-)synthetic materials was still in an early stage and it was therefore not possible to formulate a treatment methodology. An experiment was made to reconstruct the original appearance of the finish, but this resulted in new craquelure after a few weeks. It was decided to place the cabinet back in storage and wait for advancement in conservation science.

Identification: visual analysis
The FTIR analysis stated that the imitation material was made out of casein and might even be casein formaldehyde. The latter is not possible, since formaldehyde was only first synthesised in a laboratory in 1859 and the cabinet is from the 1840s. The first patents for casein formaldehyde only appear around the turn of the century. 6 The other semi-synthetic plastic from the nineteenth century, cellulose nitrate, was only commercially available after the 1860s. It also cannot be a natural material like horn, let alone tortoiseshell, because the imitation is water-sensitive and has a different pattern of craquelure. These characteristics seem to suggest a proteinaceous material, such as casein or gelatine.

The imitation tortoiseshell on the silverware cabinet has a thickness of 1 millimetre and is glued to the cabinet in sheets of equal size. The different sheets are butted against one another at regular intervals. A small sample of the imitation tortoiseshell was analysed under an optical microscope and showed a layer-wise build-up: two transparent layers, each one topped with a much thinner coloured band (figure 3). These characteristics seem to suggest a laborious process in which a plastic material was cast and dyed in different stages, resulting in relatively small sheets of imitation tortoiseshell.

Identification: historical source analysis
The author found hardly any literature on proteinaceous plastic materials published before the beginning of the twentieth century. There are, however, many nineteenth-century publications on casein or gelatine as a binding medium or glue. 7 A rare exception of literature on plastic materials is a French trade magazine from 1799 that describes
the process of wire netting, in which a sheet material is made by repeatedly dipping a wire mesh in gelatine, building it up layer by layer. However, no contemporary publications were found. The only nineteenth-century publication on proteinaceous plastics the author has found is Die Imitationen. Eine Anleitung zur Nachahmung von Natur- und Kunstprodukten (…) by the German chemist Sigmund Lehner. This title is part of the comprehensive Die Chemisch-Technische Bibliothek (volume 101), a practical book series on the latest developments in science and industry, published by A Hartleben’s Verlag in Vienna from 1875 to 1949. In Die Imitationen a process is described to imitate exotic materials like ivory, mother-of-pearl and tortoiseshell, using casein or gelatine. This process was already outdated at the time of its first publication in 1883: ‘In neuerer Zeit haben die Schildpatt-Imitationen aus Leimmasse an Werth verloren, indem man solche Imitationen weit dauerhafter unter Anwendung von Celluloid darstellen kann’. By then, imitation tortoiseshell made out of cellulose nitrate was far more durable. The casting process described in Die Imitationen might well have been applied in the 1840s. Three components are needed for the imitation tortoiseshell: a binding medium, filler and pigment. The binding medium, either casein or animal glue, has to be soluble in hot water, transparent and colourless. A filler like starch is added to increase transparency. A mixture of binding medium and filler is cast on a glass plate which is fitted to a table with screws, allowing the plate to be levelled (figure 4). Rulers have been placed on the sides and at one end to control the thickness of the casting. The surface is then evened out with a spatula, making excess material flow out on one side. When the plastic material has set, the mottled pattern of tortoiseshell is painted in with a brush. This process can be repeated to gain more depth. Afterwards the glass plate is placed in a warm room to dry and then placed in an oven to further reduce the moisture content.

In the last phase of the production process the imitation tortoiseshell is ‘hardened’ or cured in a water bath, making it less water sensitive. It is in this respect that casein and gelatine casts seem to differ most from casein formaldehyde. A curing agent imparts crosslinking to the protein and it is very likely that the degree of crosslinking largely determines the durability of the final product. A solution of formaldehyde in water is mentioned in the 1884 edition of Die Imitationen as a curing agent too, but in the 1840s, only solutions of either tannin or alum could have been used, having been applied in the production of leather for centuries. The solution cannot be too high (higher than 4-5% for formaldehyde), as it will cure the surface before it can diffuse to the core. If the concentration is too low the curing is incomplete or takes too long (up to months). This might well be the problem with both tannin and alum. However, there was no time within the research for comparative testing.

**Identification: material analysis**

New pyrolysis-GCMS analysis concluded that the imitation material was made out of gelatine and starch. A resin was not found in the second analysis or in the cross-section or solubility tests. The sample for the earlier analysis was probably taken from a section that had once been varnished to restore the level of gloss. The pyrolysis-GCMS analysis also excluded the presence of the organic curing agent of tannin. The inorganic curing agent of alum could have been analysed with FTIR, but there was no budget left within the research. It was therefore also not possible to use pyrolysis-GCMS again to determine whether the animal glue was derived from either hide or bone. The imitation material is made out of gelatine and starch with the likely addition of alum as a curing agent.

**Aim**

The silverware cabinet is one of the most extraordinary pieces in the collection of Het Loo Palace, which is a museum of the royal family that wants to display its furniture accordingly. However, the tortoiseshell imitation is an experimental material. The craquelure is part of its natural ageing, its patina, as it simply is not durable. The new treatment will therefore differ from the 1990s treatment in that it will not try to restore the original appearance. The aim of the treatment is to prevent further deterioration and bring the cabinet back into aesthetic unity again by cleaning, consolidating, and reconstructing the finish with the conservation of craquelure.

**Conservation literature**

Since the early 1990s, there has been little progress in the conservation of proteinaceous plastics, as opposed to the other nineteenth-century plastics made out of vulcanised rubber and cellulose nitrate. Some studies concerning casein formaldehyde were made, but they did not result in a treatment methodology. Kaner (2010) suggests that water can be used as a plasticizer to treat distorted...
parts, but it is not clear to what percentage it can be added or which technique is most effective.\textsuperscript{17} A further comparison of various fields of conservation on the treatment of craquelure made clear that apart from water (with or without a thickening agent), heat is often used as a plasticizer.\textsuperscript{18} Furthermore, there are some studies on the reconstruction of tortoiseshell, most notably by Williamson (2002).\textsuperscript{19} He suggests various methods for imitations out of animal glue with a curing agent to obtain specific patterns or properties. Another method is using tortoiseshell imitations out of cellulose acetate.

**Cleaning**

The tortoiseshell imitation was gently cleaned with a microfibre cloth and, where needed, with cotton swabs dampened with Shellol D40, as an aliphatic mineral spirit does not affect gelatine. This was sufficient to remove accretions of dirt.

**Consolidation**

The craquelure caused by the conservation treatment in the 1990s was traced on a sheet of Melinex. It showed that the surface had been stable during a period of about twenty years after the initial damage. It was hypothesised that the problem might not be the plasticizer itself, but the amount of added water. A modification to the amount of water could determine whether or not new damage would occur. The water could be reduced considerably, since it was only needed to treat distorted areas, not to swell the gelatine and restore the original appearance. After some tests on gelatine casts, a new test was done in a discreet area.

As a first test, a mixture of demineralised water and ethanol (1:1) was applied with a syringe. The ethanol was added to lower the surface tension, enabling the water to flow in between the finish and the substrate. After five minutes, the plasticity was tested with light finger pressure; the material had lost most of its tension. This technique, however, did not work in more strongly distorted areas. During further testing for these areas a cotton swab moistened with the mixture of water and ethanol was placed underneath the flake, or a thin layer of fish glue was brushed on its backside, depending on the degree of distortion. These techniques seemed to work. Afterwards, the swabs were removed with a tweezer and the glue with a slightly dampened microfibre cloth. The treated area was traced on a sheet of Melinex before the experiment; after a month it showed no further deterioration.

Then, testing was done to choose the best consolidant. The consolidant had to have a low viscosity...
for easy penetration, good adhesion, some elasticity to allow for dimensional change, and had to be reversible. The solvent-based acrylates Paraloid B67 and B72 proved inadequate because of their long curing time and poor adhesion. It seemed that the consolidant also needed some water to plasticise the distorted areas. Further testing showed that a mixture of fish and hide glue (1:1) worked best. It is a thin glue that is liquid at room temperature, remains flexible, and contains a relatively low percentage of water.

The distorted parts of the imitation tortoiseshell were plasticised with a mixture of water and ethanol and consolidated with a mixture of fish and hide glue. The surface was then clamped with acrylic sheets. The clamps were temporarily removed in order to wipe off the excess glue with a slightly dampened microfibre cloth. The surface was then clamped for 24 hours and cleaned again (figure 4).

Reconstruction
The appearance of the imitation tortoiseshell had to be approximated in colour, transparency, and gloss. Research into commercially-available tortoiseshell imitations showed that the matching patterns and colours were not available. Tests were done with animal glue casts, but their long-term stability was unknown. Epoxy was chosen as a casting material because it is durable, it is not sensitive to moisture, and it dries quickly without the inclusion of air bubbles. A commercial epoxy was used. It will yellow over time, as do most epoxies, but the original tortoiseshell is yellow in colour too. Moreover, the inserts can be removed since they are cast separately from the object and adhered with a reversible glue. The inserts have been documented.

The film was cast on a glass plate lightly powdered with talc and the mottled pattern was painted in with epoxy pigments that were thinned down with epoxy resin. The result was an imitation with a general match in colour and pattern, allowing for further adjustment in specific areas. The film was then scraped, sanded and sawn to fit the missing areas. Small cuts were also made with a fretsaw to imitate craquelure. If needed, the colour was adjusted by staining the adherent with Orasol stain. The pattern was adjusted by brushing Golden acrylic paint on the backside of the inserts. A mixture of fish and hide glue was used to put the inserts in place. An even gloss was obtained by saturating dull areas and small craquelure with a low molecular weight varnish. The low molecular weight varnishes have relatively short polymer chains, allowing for deep penetration. A solution of the urea-aldehyde resin Laropal A81 (20%) was used in a mixture of the hydrocarbon solvents Shellol T (aliphatic) and Shellol A (aromatic) in a 2:1 ratio. It was brushed on and repeated once. A stronger solution (40%) was used to fill the remaining craquelure, since the substrate was saturated but the cracks were not (figure 6).

Conclusion
The cabinet is finished with a rare imitation tortoiseshell made of natural glue that was probably treated with the hardening agent alum. The material is part of an early phase of the development of the relatively durable semi-synthetic casein formaldehyde, and no other examples of this imitation material are as of yet known. The imitation is experimental in nature, making the craquelure an ageing characteristic of the material.

Acknowledgements

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Notes
1 Rem 2003: 81.
4 Conversation with curator Paul Rem 03-06-2014.
6 Williams 2002: 36.
7 For instance Gintl 1874; Lehner 1892.
8 Williamson 2002: 36.
9 Lehner 1883.
10 Lehner 1883: 86.
11 Lehner 1883: 22.
12 Idem. When tortoiseshell is glued to a substrate, the weight is of course not important, only when it is used in objects like mirrors, combs etc.
13 Lehner 1883: 62.
14 Brydson, 857.
15 Conversation with curator Paul Rem 03-06-2014.
17 Kaner 2000.
It was decided not to use the conservation grade epoxies Hxtal nyl-1 or Finebond, because the surface was large, making their use very expensive. Also, the properties that make them useful in conservation, the specific refractive index and the supposed non-yellowing, were not relevant in this case.

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Photography credits

- All photos by the author unless otherwise stated.
The conservation of a lacquered dress sedan chair from the collection of the Marstallmuseum Schloss Nymphenburg in Munich

Hella Huber

Introduction

In the seventeenth and eighteenth centuries, a large number of single-seater sedan chairs were mentioned in the inventories of the Bavarian court. Unfortunately, only two splendidly decorated sedan chairs have survived; they are now housed in the Stables Museum at the Palace of Nymphenburg. Sedan chairs were designed as a means of transport without wheels, while protecting against poor weather conditions by being covered from above and often equipped with sliding windows. They were carried by two carriers, or animals using removable carrying poles and straps.

Of those two remaining single sedan chairs the older one was ordered by elector Max Emanuel from the master saddler Saillot in Paris on the occasion of his wedding with the electress Maria Antonia in 1685 (figure 1). The gold brocade and embroidered silk adornments are an indication of the high rank of its user. The outside body of this particular sedan chair is lined with a red velvet and covered with gold embroidery in raised technique. This precious stile of decoration was especially used in private state carriages and sedan chairs of the seventeenth century. It was inspired by elaborate textile wallcoverings of French apartments, which were used by the carriage and body makers trade as an example. Leading to the assumption that the softly flowing drape of the textile fabrics was less important than the optical effect in different illuminations.

The second remaining dress sedan chair in the possession of the Stables Museum is presumed to have been made sixty years later, about 1745, for Maria Anna, the wife of elector Max III Joseph (figure 2). The upright ‘coupé’ body shape and its construction are very similar to the sedan chair of Maria Antonia. As its predecessor, the inside is

Figure 1 Private sedan chair of electress Maria Antonia, Paris, c. 1684/1685.

Figure 2 Dress sedan chair of electress Maria Anna, c. 1745.

Figure 3 Dress sedan chair of electress Maria Anna, detail of the inside-trimming.
decorated with richly worked textiles. A blue gros de Tours silk with ‘droguet’ pattern is used for the wall trimming and the cushion with seat fall (figure 3). This characteristic, finely detailed pattern initially came into use in the middle of the eighteenth century and therefore supports the dating of the sedan chair into this time period as with the start of the Rococo period the straight form of the chair was already deemed old-fashioned. The curtains of the three windows consist of blue silk damask with foliage. The colouring and decoration of the chair’s bodywork were made to match the fine trimming and upholstery. Nonetheless, in contrast to the inside the bodywork is not lined with precious and expensive silk fabrics. Instead metal leaf gilding embellishes the frame construction of the sedan chair. Its incised chalk ground mimics the texture of the blue silk damask (figure 4). The fine pattern of the gros de Tours silk is copied onto the panels in lavish lacquer work using lattice-shaped surrounding of the flower sprays, rocailles and floral ornaments (figure 5).

The lining of carriages and sedan chairs with costly textiles was out of fashion. Instead ‘material illusion’ by imitating fabrics, marble, porcelain, tortoiseshell and East Asian lacquerwork using complex polychrome techniques was ‘en vogue’ and executed by specialised painters and lacquer craftsmen.

One could compare the great artistic skill of the lacquer technique of the sedan chair to the impressive polychrome painting of the vernis Martin on some furniture manufactured by Mathieu Criard for Madame de Mailly’s chambre bleu in Chateau de Choisy.3 The lacquer décor of this furniture with Rococo ornaments and flowers was probably made in a workshop of the famous lacquerer of the Martin family.4 The special light blue Rococo lacquer decoration was made at the same time as the sedan chair in the mid-eighteenth century. At this particular time the decorative motifs and colours of this type of lacquerwork no longer followed the East Asian role models, but changed to western Rococo décor.

**Polychrome painting**

In view of the upcoming conservation and a better understanding of the special painting techniques the polychrome finish of the lacquered sedan chair was investigated. Following a preliminary examination, cross-sections were prepared to detect and, if possible, categorise the layering of the surface.5 Microscopic investigation under visible and UV light, complemented by histochemical staining was applied to determine the presence of different types of binding media.6 Additional samples were taken for further analysis.7

**Stratigraphy of the blue silk damask imitation**

A glue size was applied to the beech frame construction first. The cross-section (figures 6a, b) then shows a multilayered chalk ground which was applied relatively thick since it had to be engraved later. The chalk ground is followed by an orange-red bole and silver leaf. While examining the sample under the microscope using UV light a very fine intermediate layer on top of the metal leaf could be identified as a proteinaceous medium, which is covered with a thin transparent blue layer, probably consisting of Prussian blue.8 This thin blue layer lays next to a thin transparent clear layer and is hardly visible in the cross-section, leading to
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The assumption that the original metal leaf gilding was not completely coated with the blue glaze. However, the transparent finishing lacquer is presumed to have been applied over the entire area. The first overpaint is a layered coating showing a thick, brittle transparent lacquer under a very thin blue glaze. The following stratigraphy consists of further silver leaf gilding over a reddish mixtion covered with a transparent black-brownish coating. Remnants of different coloured glazes in other areas of the frame construction indicate that some parts were only partially overpainted.

Further examination of the paint layers shows that the metal leaf gilding of the frame construction had been applied before the lacquerwork of the panels was carried out. This can be observed on the protruding metal leaf which was covered with the same blue paint layers that was used on the panels.

**Imitation of the gros de Tours silk**

The thin softwood panels are covered with a lining glued to both sides. Here the cross-section (figures 7a, b) displays the original lacquer buildup consisting of ‘double’ ground, paint layer, decoration and transparent lacquer layer. The first layer of the multi-layered chalk ground is relatively thin and has a characteristic greyish hue. The following blue layer of azurite and perhaps lead white has probably been applied in two steps. In some parts of the cross-section the upper layer of the blue is darker whereas the lower layer contains more white pigment. Through histochemical staining with Ponceau S a fluorescent thin proteinaceous isolation layer could be made visible on top of the blue azurite application. All paint layers underneath are also bound with a proteinaceous medium. The following lacquer décor consists of a thin grey layer with less fluorescence. With a higher magnification non-fluorescent particles embedded in a brownish matrix are visible. Those particles have been identified as tin. They are likely to be interspersed in the moist, grey-pigmented oil binding medium. The cross-section shows the part of the pattern where the tin particles had been removed with a special tool (figure 8). This mechanical interference changed the colour of the middle dot of the ‘droguet’ pattern from silver to grey, and was done after the lacquerwork was completed.

**Figure 6** Cross-section from the frame construction (right side, bottom on the right): Paint section showing the thin translucent blue glaze on silver leaf gilding; 1. yellowish-white ground; 2. orange-red bole; 3. silver leaf; 4. blue glaze; 5. thin transparent coating; 6. overpainting. Sample viewed in visible light (a) and UV light (b), photographed at a magnification of 200x.

**Figure 7** Cross-section from the rear panel (bottom): Paint section showing the blue lacquer structure: 1. greyish ground; 2. white ground; 3. blue paint layer; 4. grey metal powder; 5. overpainting. Sample viewed in visible light (a) and UV-light (b), photographed at a magnification of 200x.
The dark blue parts of the lacquer pattern consist of a homogenous layer of Prussian blue. This layer is not visible in the cross-section, neither is the remaining thin layer of the original glossy lacquer. When comparing this to the first overpainting lacquer of the frame construction the overpainting of the panels shows a very thick transparent coat. Non-fluorescent particles indicate that it had been sanded in between applications. In addition and as a result of ageing this lacquer layer has undergone substantial changes in structure and colouration. The cross-section also shows the distinctive brittleness of this layer and highlights further thin coatings of overpaint composed of a transparent layer, followed by a sparse black pigmented coating.

**Overpainting and condition before treatment**

At least two later polychrome phases can be identified in the cross-sections of the sedan chair. In some areas of the frame construction additional paint layers could be observed. Obviously, the original thin transparent finishing lacquer was damaged or destroyed by the formation of cracks and flaking, leading to the removal of almost the complete transparent lacquer of the panels during the first restoration period. Thus the slightly raised décor of tin particles and parts of the oil-based paint layer had been severely reduced. At the same time, the silver leaf gilding of the frame construction was overpainted too. Large areas were given a new chalk ground and new engravings, which did not derive from the floral pattern of the silk damask but from the geometric forms of the borders (see figures 3, 9).
Moreover, the overpainting revealed serious alterations due to ageing. In some areas the greenish blue surface colour had turned more yellow. The brittleness of the coating as well as the corrosion of the silver leaves is clearly recognisable. This was most likely the reason for overworking the surface twice at some later stage, which included the sanding and reduction of the thick, discoloured lacquer coating (figure 10).

UV light examination revealed extended parts of exposed azurite layer with no fluorescence (figure 11). The now unprotected azurite ground was exposed to humidity fluctuations causing the sensitive protein bound layer to form blisters raising the ground layer (figure 12). In addition, some of the degraded and cracked yellow coating had not been completely removed, leaving a patchy surface while hiding some of the fine details of the original painting and metal powder decoration underneath (figure 13).

Finally, the patchy appearance of the paint surface, the exposure of different paint layers, and the misinterpretation of the historical colour scheme led to further alterations of the polychrome surface. As a consequence the aspired visual effect of the original polychrome coating could not be ascertained anymore. Thus the décor of the panels was described in some publications as ‘white flowers and rocaille ornaments’ or ‘gold painted flowers and rocaillés’.

Reconstruction of the painting techniques

The restoration concept included a reconstruction of the textile imitation using mockups to recreate the layered structure of this particular surface décor. The selection of the materials and methods to recreate those textile imitations was based on the findings of the preliminary examination and analysis, as well as recipes from contemporary sources. The goal was to use those mockups to evaluate conservation materials and retouching methods and to envision the original surface appearance and colour scheme of the sedan chair.

Reconstruction of the blue silk damask imitation

To reconstruct the silver leaf gilding with the blue glaze of the frame construction a multi-layered chalk ground was applied on a well prepared and sized wooden surface (figure 14). After drying, the contours and details of the pattern were carved into the chalk ground using special engraving tools. Next, a red bole was spread over the chalk ground, followed by the silver leaf gilding. Then the embossed parts were burnished with an agate,
although, due to the overpainted and fragmentary condition of the original silver leaf gilding, neither cross-section analysis nor close-up inspection of the polychrome areas had revealed burnished and non-burnished parts on the original surface.

After burnishing the surface was sized using isinglass. The use of glue as an intermediate layer on metal leaf before lacquer application is frequently mentioned in technical sources. It increases the wetting properties on the metal and prevents bleaching and tarnishing which sometimes occur when a highly diluted lacquer or glaze in highly volatile solvents is applied. At last, a glaze of Prussian blue, an ideal and often referred to pigment for transparent glazes on silver leaf gilding was brushed on the silver surface and covered with a thin white spirit lacquer.

The engraved chalk ground imitates the texture and threads of the blue silk damask used for the curtains of the sedan chair, and the silver leaf gilding acts as a reflective interface for the applied blue glaze. The interchanging glossy and matt surface appearance triggered by the partially burnished silver leaf gilding and the Prussian blue glaze give the sophisticated effect of the shimmering and iridescent silk, strikingly similar to the curtains from inside of the sedan chair (figure 15).

**Reconstruction of the gros de Tours silk**

Neither the very rare technique of blue lacquerwork based on azurite in an aqueous binding medium nor the decoration with tin powder are described accurately in the painter’s handbooks of the seventeenth and eighteenth centuries. Although it was well-known that azurite in binding media such as drying oils and resins turns greenish or dark, it still was recommended to be used in combination with lacquer. Perhaps if the surface was to remain light blue sometimes the use of an aqueous binding medium was suggested. Therefore most historical blue lacquer recipes do not contain azurite as a main colourant but instead pigments like smalt and Prussian blue.

Based on the results of the preliminary examination the azurite was mixed with different amounts of lead white in a proteinaceous medium. These mixtures were then applied thinly on a multi-layered chalk ground (figure 16). The dark blue lacquer décor was painted with oil-bound Prussian blue on an additional intermediate layer of isinglass. Then the metal powder decoration was carried out by scattering loose tin particles into
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The still moist, grey-pigmented oil paint (figure 17). After drying, the remaining tin powder could be brushed off and the surface of the metal application was burnished with an agate, changing the dull grey surface colour into bright silver. Then some details and contours were accentuated in dark grey oil paint. Finally, the middle dot of the ‘droguet’ pattern was scraped with a spatula, thus partly abrading the tin powder and leaving the surface rough and dull grey. This colour change effect was accentuated by the grey oil paint layer underneath which was exposed by this action.

The unvarnished mockup showed a slightly crystalline luster of the azurite paint layer. But a final coating with a thin lacquer increased both the depth of the blue background and the reflective properties of the white ground. The lustrous effects of the slightly raised tin decoration evoke an impression similar to the gloss of the real silk textile (figure 18).

Restoration concept of the clear lacquer

As already mentioned, the textile imitations of the sedan chair have been overworked and restored several times. During the last session, the removal of the thick transparent lacquer which had been applied during the first renovation was not executed consistently. First it was tried to ‘regenerate’ the brittle lacquer by using liquid solvents or solvent vapour. But various attempts of regeneration failed, probably due to the advanced degree of degradation. After evaporation of the solvents the surface remained crazed, rough and opaque.

Due to the vain restoration attempts the removal of the overpainted lacquer was considered, and as a new finish a historical lacquer was seen as a possibility. Several recipes from the painters’ handbooks for the preparation of ‘white lacquer for light colours’ were tested using the mock-ups. Satisfactory results could be achieved using a smooth but polishable sandarac-based lacquer according to Watin, which contained mastic and turpentine as well as elemi. But a historical lacquer may be subject to yellowing and cracking, leading to a comparable surface effect of the original white spirit lacquer. After discussion with other stakeholders, it was decided that the slightly yellowish natural colour as well as the yellowing and embrittlement of natural resin lacquers were undesired. Then the application of a dammar resin or ketone resin (MS2A) was proposed, but both resins were rejected because of their likewise brittleness and their decreasing reversibility after ageing. In the case of a future varnish removal this would increase the risk of damaging the original lacquer.

Finally, because of its extraordinary stability and optical properties the low molecular weight hydrocarbon resin Regalrez 1126 was proposed, in combination with Kraton G1650, a linear triblock copolymer based on styrene and ethylene/butylene, and the hindered amine light stabilizer Tinuvin 292. The resin mixture can be dissolved in low aromatic mineral spirits which avoids interfering
with the historical paint layers while leaching during application as well as during future removal is unlikely to happen. Furthermore, this solution is less toxic during the working process.

While trying to find a suitable ‘material imitation’ for the original white lacquer this synthetic resin with additives was tested in different solvent systems and with changing application methods to achieve a finish similar to a polished spirit lacquer.

**Treatment**

After the selection of a new varnish and application technique the very thick lacquer varnish from the first restoration period was removed using hydroxypropyl cellulose gel (Klucel E) dissolved in isopropanol (figure 19). The later addition of the dark coating on the frame construction was reduced with different polar solvent systems to closely match the hue of the top silver leaf gilding (figure 20). The Regalrez varnish was dissolved in hydrocarbon solvents of varying boiling range, and applied with a spray gun (figure 21). Irregularities of the surface as well as the tendency of the lacquer to slip from the smooth metal decoration and accumulate on the rougher paint surface areas required the application of many successive thin layers under varying spraying conditions.

Irregularities of the applied Regalrez film could be smoothened by polishing the dried surface several times. Due to a slight orange peel effect an additional coating of a very thin final Regalrez layer was brushed on after the last polishing. No re-dissolving of the underlying coating could be observed due to the use of fast evaporating hydrocarbon solvents. After finishing the new Regalrez surface coating looked a little bit streaky, but very similar to traditional brushed and polished white spirit lacquers.

**Conclusion**

The skilled gilder and lacquerer of the sedan chair achieved an effect that matches the textile fabrics of the sedan chair thanks to complex and sophis-
The conservation of a lacquered dress sedan chair from the collection of the Marstallmuseum Schloss Nymphenburg in Munich
ticated textile imitating techniques by coping with the variety of surface textures as well as the reflection of light.

The substitution of the degraded secondary lacquer on the sky blue azurite surface from an earlier restoration especially intensified the effect of depth and reflection of the light (figure 22). In fact, although the synthetic Regalrez varnish has a comparable refractive index, the quality and gloss as well as the slight colouring of the eighteenth-century clear lacquer could not be completely obtained with the modern substitute material.

Despite the removal of the disrupting secondary finish the intention of this restoration project was not to regain the original surface condition of the sedan chair but to preserve the aged state of the finish with later changes and additions as a historical document. Weighing up conservation ethics and aesthetic requirements, a meticulous reconstruction of the original colour scheme and the optical effects of this complex textile imitation was aspired (figure 23).

Acknowledgement
I would like to thank Dipl. Rest. Heike Winkelbauer (Institute for Conservation, Academy of fine Arts Vienna) for the critical reading and the English correction of this paper.

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Notes
1 In this instance, Maria Antonia, the daughter of Emperor Leopold I, was allowed to use gold brocade on the seat of her sedan chair, though in general only items which are associated with the emperor were decorated with golden materials. See R.H. Wackernagel (ed.), Staats- und Galawagen der Wittelsbacher, vol. 1, Stuttgart 2002, p. 81.
3 I would like to thank Dr. Monika Kopplin, Museum für Lackkunst Münster, for this information.
5 The samples were embedded in Scandiplast polyester resin and examined under a Leica DMRX microscope, equipped with a high-pressure 100 Watt mercury lamp and a 100 Watt halogen lamp. For the fluorescence microscopy the filter set D-violett-excitation (BP 355-425 RKP 455 LP 460) is used.
6 Ponceau S, Ikanna and Sudan black dyes were used as indicators for proteins, resin and oil. See H.P. Schramm, B. Hering, Historische Malmaterialien und ihre Identifizierung,

7 The pigment analysis with UV-VIS Spectroscopy and µ-RFA was conducted by Dr. Heinrich Piening, Conservation Department, Bavarian Department of State-owned Palaces, Gardens and Lakes.

8 Prussian blue was probably used as pigmentation for the coloured glaze but could not be identified with absolute certainty by analysis.


10 See e.g.: J.M. Cröker, Der wohl anführende Maler, Jena 1736, pp. 242-243; Pater Bonanni, Neuer Tractat von Firniß_ Laquier- und Mahler-Künsten, Breßlau, Leipzig, 1746, 30; J.F. Watin, Der Staffimmeral, oder die Kunst anzustreichen, zu vergolden und zu lackiren, wie solche bey Gebäuden, Meublen, Galanteriewaren, Kutschen, u.s.w. auf die beste, leichteste und einfachste Art anzuwenden ist: sowohl den Künstlern als den Liebhabern zum Unterricht herausgegeben, Leipzig 1779, p. 146.


12 J.-F. Watin, L’art du Vernisseur, Paris 1776, 228. The recipe is entitled: ‘Vernis blanc qu’on peut polir, pour le chambranles, boites des toilette, etc.’.


14 Because the original lacquer obviously had been removed due to poor ageing characteristics and durability it was assumed to be less suitable and should not be reconstructed. For the selection of ‘cheap lacquer systems’ with bad ageing characteristics on blue lacquerwork see: U. Baumer, J.K. Koller, ‘Blaue Lacke des 18. Jahrhunderts. Eine naturwissenschaftliche Untersuchung historischer blauer Lackarbeiten’, in: Lacke des Barock und Rokoko, Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege, vol. 112, München 1997, pp. 455-466, 464.

15 See Watin 1776 (note 12), p. 228.


19 The removal first was tested with a Carbol 980-isopropanol gel. When applied to the lacquer it was substituted using a Klucel E-based gel. Despite poor working properties it was used to prevent the formation of reactive compounds in the original paint layer. After two minutes application time the 9% gel was swapped together with the dissolved lacquer. Finally, the surface was carefully cleaned with ethanol.

A trompe-l’oeil scagliola top on a three-legged support

Lisya Biçaçi, Jaap Boonstra

Introduction
In March 1999, the Amsterdam Historical Museum acquired at auction a rare Louis XV console table with scagliola top on a cypress wood support, from the third quarter of the eighteenth century. The serpentine shaped top is decorated with a trompe-l’oeil picture of various papers spread out on a dark grey, marbled ground, with a moulded border. The depicted engravings, architectural drawing and map have apparently been copied from the personal papers of the first owner, the Amsterdam tea merchant Mr Matthijs Herfst, whose card is in the left rear corner. The name of the scagliola worker can be found on the edge of the map, ‘Adolphe Jacque fecit Bonna anno 1761’. The top rests on a foliate and rocaille carved frieze, supported by three scrolled cabriole legs with claw and ball feet, which are joined by curved foliate stretchers.

The striking table top fits the theme of the conference: two widely different materials, paper ephemera and durable marble, are imitated in yet another, a mix of gypsum, glue size and pigments, generally known as scagliola. This imitation technique had already quite a tradition by the end of the eighteenth century. In seventeenth-century Italy and Southern Germany, interior architecture and objects such as table tops were decorated with stone imitations made in this material, sometimes simulating pietra dura work. Trompe-l’oeil images of papers and three-dimensional objects such as flowers, writing implements and even musical instruments occur as well. What sets apart the work by Jacque however is the selection of the documents, engravings and maps he depicts. The mere six works that are known of him to date - all of them table tops - show papers which were carefully chosen to serve as an introduction to the owner and commissioner of the work. They mention his name and inform the viewer about personal views and social status. After Herfst’s death in 1785 the table was probably inherited by his children. When, in the early nineteenth century, the Napoleonic rule over the Netherlands ended, Rococo style furniture, which was generally associated with the French, had become unfashionable and was frequently sold off. After a long period in private ownership abroad, the table resurfaced when it came up for auction. At first in the United Kingdom in 1996 and three years later at Sotheby’s Amsterdam, where the Amsterdam Historical Museum was able to purchase it at 65,000 Dutch guilders (29,550 Euros). Study, research and treatment were then started by Jaap Boonstra, furniture conservator of the museum, who was later joined by Lisya Biçaçi, ceramics, glass and stone conservator in private practice.

The top – the trompe-l’oeil effect
In cross section, the loose top consists of an 8 mm layer of coloured gypsum on a core of circa 22 mm thick mortar. At the time of acquisition, the top was
also backed with a stone slab which added another 11 mm to the total thickness.

Scagliola is made of a coloured paste composed of gypsum, pigments and glue size. Several batches of differently coloured pastes are mixed and kneaded together and pressed on a flat surface. After hardening the surface is scraped, sanded and polished. Small defects like scratches and cavities are filled and the surface is once again polished and burnished. The final burnishing produces a low sheen and compacts the surface. Further decoration can then be added by gouging out a recess in the scagliola surface which is filled with a fresh colour paste of choice. The polishing procedure is repeated, followed by engraving which adds the final detail. The top reads as a statement about its first owner Mr Herfst; his royalist views are illustrated by the portraits of the two stadtholders William of Orange and Maurice of Nassau. Interestingly, the degree of realism which Jacque achieved can still be checked against origial prints.

Jacque indicated the age of the prints by giving a yellowish tone to the simulated paper. Also, William’s portrait is rather damaged by creases and folds. The trompe-l’oeil effect is enhanced by the casual arrangement of papers that sometimes overlap. As a final illusionistic device, the edges of the portrait of Maurice appear to have been cut just a moment ago; the ‘paper clippings’ still lie scattered around.

The map on top of a stack of other papers to the right shows the geographical span of Mr Herfst’s personal background; the Low Countries and the Rhineland are shown with topographical names in a curious mixture of Dutch, German and Latin. In the centre of the table top the elevation of a canal house draws the attention (figure 7). A caption underneath says (in French) that it is a drawing of the house of Mr Herfst at the Singel canal in Amsterdam. As the renovation of Herfst’s house at Singel 397 was completed in 1761 - the same year
that the top is dated - the table was presumably ordered to commemorate this event. The original architectural drawing is not known, but it is possible to compare the scagliola copy to the house as it still stands today. This shows that the picture is fairly accurate; the disposition of the windows and door and the general proportions of the facade are quite recognisable albeit that the reddish marble façade must be considered an artistic liberty. The most obvious change is the nineteenth-century modernisation of the gabled top to a straight cornice. We may infer from the above that Jacque must have been as much an accomplished engraver as he was a scagliola worker, a combined specialisation that enabled him to faithfully copy, in gypsum, the documents and artworks on paper he was supplied with by his client.

The support - a three-legged console

The cypress wood support was made to match the expensive top. The choice of wood, indicative of the fashion of the time; it is very similar to cedar wood, a preferred wood species for wall panelling and furniture in the Potsdam palaces of Frederic II in the mid-eighteenth century. The carving is of a typical Rococo style, signified by the compound curves in the legs that support a frieze with 'agraffes' composed of lightly asymmetrical c-shapes and rippled shell forms. The recessed frieze is bordered by foliate scrolls and acanthus leaves on the front corners. The legs are joined below by foliate stretchers and rest on claw-and-ball feet.
By way of comparison, four tables belonging to the Elector Clemens August for which Jacque made the tops in 1757-1758, are markedly different. As they were intended for the much grander, palatial interiors of castle Augustusburg in Brühl, they are larger in scale and show much bulkier carving and are completely painted and gilded. Stylistic traits of the Amsterdam table such as the carved claw-and-ball feet and the use of natural coloured wood were, on the other hand, favoured in Dutch furniture and suggest that the support may have originated in a region close to the Dutch border where cultural interaction was strong, or in the Netherlands. Rococo style furniture made in Aachen sometimes shows similar carvings and a preference for natural, unpainted wood. However, as console tables do not seem to be a characteristic furniture type in the civic culture of the Aachen area, directly comparable models are hard to find.

The frieze of the support may be compared to the work that sculptors produced for other interior elements, such as, for example, the marble surrounds of fire places in castle Augustusburg or a frame belonging to the painting of the coats of arms and names of the regents of the Aalmoezeniers orphanage in Amsterdam, 1764.

Ornamental prints by engravers of the period, such as Juste Aurèle Meissonnier, Pierre-Edmé Babel and Franz Xaver Habermann, do not show exact prototypes of our table but their designs incorporate many individual elements such as the repetitive scrollwork, the agraffe shapes and the acanthus leaves that we also encounter in the carvings of the table.

The construction of the support has the typical rough quality of a carver’s workmanship; it has somewhat improvised joinery of flimsy pegged mortise-and-tenon joints and rails that are made from relatively small and thin sections of wood. The third leg is an unusual feature for a console table, a type of furniture with usually just one or two front legs that are elegantly curving back. For stability, the back rail then needs to be firmly bracketed to the wall. Architectural furniture such as consoles usually conformed with the wall design which determined their position and decoration.

The fact that our table is self-supporting and not a console table in the strictest sense might be an indication that the design of the room was not specified or not known in such detail to the carver. Extraordinary pieces of furniture like our table must have formed a special category, which could be integrated in an interior as an exotic element.
As the inside pier walls between the windows at Singel 397 measure a mere 55 cm, the table is too wide to have stood there. Nonetheless, one may safely assume that it was not moved very often and probably had a permanent position, possibly a prominent place on the adjacent wall opposite the fireplace.

**Condition**

**Scagliola top**

The table had sustained severe damages from long use and previous repairs. Judging by the pattern of old cracks, the top had once broken into about 25 parts. This damage had necessitated repairs of the top, firstly by re-adhering the broken pieces of scagliola. This seems to have been done mainly using gypsum, but unfortunately, the fragments were not always realigned correctly. The uneven surface which resulted from this was then levelled in places using coarse abrasive methods. Obviously, this caused a sad loss of detail, since the engraving is concentrated in a fraction of a millimetre of the top surface layer. Subsequent re-polishing also caused coloured material to spread and become embedded. Locally, smears of the black filling of the engraving occurred, soiling adjacent areas. Sometimes remains of the white gypsum repair material were left on the surface as well. The original sheen of the surface had lessened because of the re-polishing. To remedy this, extra layers of wax had been applied.

The entire top was then backed with a stone slab, probably intended as an extra precaution against collapse. Plaster had been used to adhere the top to this support.

The moulded edges of the top have lost much of their original crisp outline, especially at the exposed front corners. Permanent losses of the coloured scagliola, such as chips along the cracks and around the edge of the top were filled with new gypsum (circa nine major fills), often of a markedly different black, brownish and white tone. The surface was flawed by countless small pits filled with dirt. The thick coat of wax had accumulated a lot of dirt which further obscured decorative details of the top. Wear and tear was shown by random scratches and moisture marks that had marred the relatively soft gypsum surface.

**Wooden support**

In the past, all three legs had been broken at their joints with the lower stretchers. The two curved
front stretchers had split half way along their length. Judging by the variety of repairs apparent in the woodwork, the damages had happened on several occasions. An important cause of the collapse of the support was the structural weakness of the strongly curved stretchers and legs which contain a large amount of weak cross-grained timber. The increased weight of the top with its stone backing, further compromised the stability of the support. The damages had resulted in a loss of material around the breaks which had been addressed with ill-fitting repairs made up of various species of wood and a surplus of glue. The inability of traditional adhesives to meet the demands of the construction had called for reinforcement with nails, screws and other metalware. The detached claw-and-ball feet had been reattached using forged iron angle brackets and braces that were either nailed or screwed on. Although these hand-forged metal plates had apparently been fitted individually, some of the original material had been removed to improve the fit. This again resulted in a loss of carved details. The nails and screws caused splits in the wood, made worse by later rusting, weakening the structure further.
A trompe-l’oeil scagliola top on a three-legged support

Later repair campaigns introduced modern gap fillers like plastic wood and modern glues such as epoxy. Exposed elements of carving that had been knocked off had invariably been replaced with non-matching wood species such as mahogany, oak and pine. The crude repair work hardly ever succeeded in properly realigning the old fragments. To make matters worse, the colour differences that occurred between repairs and original material had probably inspired the application of an all-obscuring opaque dark brown varnish. This final coating was brushed on thickly and showed a heavy craquelure. It effectively masked the grain and texture of the cypress wood (figure 9). Some shrinkage had also occurred, which caused splits in the wood, and possibly deformation of the curved elements such as the stretchers and cabriole legs. This aspect of change remains a bit speculative and hard to verify. Panel construction or right-angled joinery is absent in the support, which makes it hard to find reference points to establish shrinkage or warping.

Summing up; both the top and support had been heavily damaged. The early restoration techniques and the array of materials employed to remedy this had done more harm than good, both at the point of their initial use and in the years that followed. Original material had often been sacrificed during these treatments, resulting in damages to the artwork. The repairs to the construction were mostly inadequate, compromising the stability of the object.

Investigative techniques, research, analysis, cleaning tests

Scagliola top
To gain a better understanding of the damages of the top, a tracing was made of the fracture patterns. It was converted into a line drawing, in which fills and suspected fills were indicated (figure 13). The topography of cracks and fills could then be compared with information drawn from X-radiographs that surprisingly showed the shape and outline of a hidden metal armature. This appeared to consist of twelve scrap metal pieces embedded in the scagliola matrix. It was noted that the fracture patterns were often associated with the location of the metal. Apparently, the inflexible metal had formed a shear line when the top fell and broke. Another aspect that showed up on the X-rays were some of the higher density pigments in the scagliola, for instance in the coastline and the coat of arms on the map.

The condition of the surface was examined under ultraviolet illumination which clearly showed how accumulated dirt was present in the wax layers. Bright fluorescence was observed in specific areas such as the border of the map, the coastlines and the posts and lintels of door and windows. This fluorescing appears to be caused by a resinous top layer as the pigments present are not known to fluoresce.

Specific analysis of binding media and pigments was then carried out focusing on the finishing
layers, the comparison between the composition of the scagliola and suspected later fills and the pigments used in the scagliola. The analytical techniques applied were infrared spectrometry, gas chromatography coupled with mass spectrometry, X-ray fluorescence spectrometry (the handheld Bruker Tracer III-V), polarised microscopy, scanning electron microscopy element dispersive radiography.

IR showed beeswax was present in the top coating. GC-MS indicated that in later repair fills no binder was present, whilst in the original scagliola protein glue was found. Linseed oil was also identified by GC-MS as a component of the original surface. XRF was used as a non-destructive pre-selection tool to find promising sampling areas for pigment analysis. Further analysis of these samples was then carried out by polarised light microscopy and SEM-EDX. Table 1 sums up the pigments that were found:

Based on this information concerning the pigments, fillers, coatings and binders present in the scagliola, solvents were selected for test cleaning of the soiled surface coating. Solvents or solvent combinations such as white spirit, acetone, acetone-xylene or acetone-ethanol applied with lightly moistened cotton swaps delivered poor results. White spirit had the additional drawback of being retained in the porous material, causing a temporary staining. Ethyl-acetate was effective but unsafe as fillings of the engraving started to

<table>
<thead>
<tr>
<th>Sample location</th>
<th>elements</th>
<th>material</th>
</tr>
</thead>
<tbody>
<tr>
<td>coat of arms with lion</td>
<td>blue, red</td>
<td>Ca, S, As, Hg, (Sr), Fe</td>
</tr>
<tr>
<td>dark area tabletop</td>
<td>dark grey</td>
<td>Ca, s, As, (Sr), Fe</td>
</tr>
<tr>
<td>yellow background text 'scipiadas'</td>
<td>yellow</td>
<td>Ca, S, Fe, (Sr)</td>
</tr>
<tr>
<td>green background of the house</td>
<td>greenish</td>
<td>Ca, S, (Pb), (Sr)</td>
</tr>
<tr>
<td>brown background, picture with William of Orange</td>
<td>light brown</td>
<td>Ca, S, (Pb), (Sr)</td>
</tr>
<tr>
<td>blue shadow of the house</td>
<td>light grey blue</td>
<td>Ca, S, (Sr), (Pb), (Fe)</td>
</tr>
<tr>
<td>Ameland</td>
<td></td>
<td>Ca, Pb, S, (Sr), (Fe)</td>
</tr>
<tr>
<td>doorpost of the house</td>
<td></td>
<td>Ca, S, As, (Pb), (Sr), (Fe)</td>
</tr>
<tr>
<td>coastline north of The IJ river</td>
<td></td>
<td>Ca, S, Pb, (Sr), (Fe)q</td>
</tr>
<tr>
<td>northern border of Groningen</td>
<td></td>
<td>Ca, S, As, (Pb), (Sr), (Fe)</td>
</tr>
</tbody>
</table>

Table 1 Pigment analysis results.
dissolve as well. In addition, there was the aspect of clearance; we felt there was a risk that solvents would transport dissolved material back into the porous gypsum. The cleaning technique sometimes needed small adjustments. For instance, on areas with thick wax layers, a short wetting with solvent, followed by mechanical cleaning (picking) was effective. In general, solvents administered in gels, emulsions and compresses worked in a more controlled fashion and were most effective. (See for details the treatment paragraph below.)

As part of the treatment, the modern gypsum adhesive layer between the scagliola and the stone slab was cut by means of a frame saw with a 5 cm wide blade. Thus, the scagliola top was separated from its backing. This enabled us to check, from the underside, the joints between fragments. No apparent instability was observed. The composition of the coarse mortar, some odd traces such as drill holes and scratch marks could be seen.

Although quite a lot of technical information about scagliola can be found in literature, we thought it would be useful to get a better ‘feel’ for the material by producing a small batch of scagliola samples. This did indeed provide us with some useful pointers about the material.

Gypsum comes in various qualities and has a limited shelf life. To achieve the correct hardness and avoid porosity, use a fresh alabaster gypsum. When gypsum is mixed with a diluted glue size, the size functions as a retardant. Small variations in the concentration of the glue size have an effect on the setting time of the paste. Too high concentrations of glue may cause shrinkage.

Pigments may influence the setting time as well. Some pigments will cause a faster setting of the paste than others. The mixture ratio of pigments and gypsum influences the end result. The hardness of the scagliola diminishes with an increasing amount of pigments. It is essential to polish the hardened scagliola with progressively finer grades of polishing stones or papers. After every polishing step, small defects such as air bubbles should be filled with a thin slurry of coloured paste. The final polishing steps will burnish and compact the surface, which improves hardness and gloss. The repeated polishing will also unavoidably cause pigments to spread and contaminate adjacent areas of a different colour. This may complicate the interpretation of surface analysis.

Inlaying by pressing gypsum paste in a gouged out recess depends on correct mixture proportions to achieve good bonding and avoid shrinkage.

### Wooden support

An earlier assessment of the support had indicated that the wood had been refinished as part of a repair treatment, however, we remained uncertain about the presence and stratification of the earlier surface coatings. Samples were taken from the surface coating for cross-sectional analysis using a compound light microscope. The samples showed that an early, possibly original, varnish layer with a white fluorescence was still present on the wood which had been re-coated at least three times. Two
resinous varnishes with a more yellowish-orange fluorescence had been applied on top of it and finally the all-obscuring dark brown pigmented varnish had been brushed on to cover it all.

To establish whether the disfiguring secondary finishes were removable, solvent test cleaning was attempted initially. Polar solvents such as ethanol and isopropanol removed the dark brown layer but also affected the underlying finish layer. Attempts at controlling the action of solvents by mixing them into gels brought only limited success. An additional problem of solvent cleaning was the re-deposition of dark remnants of material in the cracks and crevices of the original varnish. Fortunately, a different approach soon offered itself as a promising alternative. Due to its brittleness and poor adhesion, the dark brown top layer could be removed mechanically by picking with dental instruments and spatulas. The sideways thrust of small highly polished, round tipped instruments was sufficient to dislodge the upper layer without apparent damage to the substrate.

Wood identification of thin sections was done by transmitted light microscopy. In order to document the curves, the outline of the legs and front stretchers was traced onto a transparent foil before dismantling the structure. Perhaps unsurprisingly, the left and right legs turned out to be mirror images, as were the left and right front stretchers. This proved quite help-
A trompe-l’oeil scagliola top on a three-legged support

ful when a section was missing on one side but still present on the opposite part. The drawn outlines were later used as a control to check the accuracy of the reassembled parts.

Treatment Scagliola top

Cleaning

The conservation treatment of the top aimed at improving the legibility of the object, which meant that treatment of the surface was given preference. The removal of soiled finish layers and disfiguring remnants of earlier repair fills were addressed first. Non-matching retouches and fills were then toned in. While gaps and cracks in the surface would need to be filled, no attempt was to be made to reposition the misaligned fragments of scagliola. Although, in several places, these fragments had been fitted without being exactly aligned in the horizontal or vertical plane, the surface had been redressed since, so repositioning would never be able to achieve a convincing and satisfying aesthetical effect. Moreover, dismantling of the top fragments would probably cause additional damage and was therefore not considered.

Cleaning the top started with the removal of wax layers and grime. After attempts described in the paragraph above, the most effective and safest technique was an alternate application of an emulsion and a solvent gel based on formulas suggested by Richard Wolbers of Delaware University.

**Emulsion formula O/W**

50 ml Shellsol D60 (D: de-aromatised grades)
20 ml Triton x-100, non-ionic cleaning agent, complemented with demineralised water and shaken, until an emulsion has formed
For a thicker emulsion formula 50/50 ShellSol D60 and demineralised water is used

**Solvent gel formula**

100 ml xylene
20 ml Ethomeen C-25
2 g Carbopol 934
1.5 ml demineralised water
Few drops of surfactant

Carbopol and Ethomeen were first mixed to avoid agglomeration, then the solvent was added. A few drops of surfactant and finally demineralised water were slowly added until a homogeneous gel was obtained. After treatment, to remove any remains

Figure 28 Cleaning the top during Richard Wolbers’ course.

Figure 29 Detail: a. before and b. after removal of the dirt from scratches and marks.
Figure 30  Detail: a. before and b. after filling.

Figure 31  a. and b. new fill during treatment.

Figure 32  Detail of old fill; a. before and b. after retouching.

Figure 33  Reference map, c. 1773 from Nieuwe Geographische Reize- en Zak-Atlas, Jan Christiaan Sepp, Boekverkoper te Amsterdam, 1773.

Figure 34  Detail of map a. before and b. after retouching.
on the surface, an acid-free tissue slightly moistened with white spirit was used to clean the treated area. Finally, a moisture absorbing tissue was used to ensure a dry surface.

**Filling**

Although scagliola is, to some extent, porous, it has a quite hard matrix due to additions mentioned before. The larger losses were filled with off-white, low-expansion dental gypsum Silky Rock (SR) which is a harder type of gypsum. It also has a good flow and very smooth finish. Smaller missing areas were filled with Modostuc with an extra few drops of pH neutral PVAC. All areas to be filled were first sealed with Paraloid B72, 5% in acetone.

**Retouching**

Retouching was necessary for the newly filled areas and for covering unsightly old repairs. As a standard method, a wax barrier layer was applied to these areas prior to in-painting with water based fluid acrylic paint (Golden).

Some areas of the map of the Low Countries were missing due to damages and levelling treatments in the past. Assuming that the artist had used actual maps, we looked at old maps to help to reconstruct the continuity of the essential geographical features that were lost. However, study of maps from different periods (circa 1730-1773) gave the impression that the artist had drawn his own interpretation of a map rather than a precise reproduction. The map on figure 33, though of a somewhat later date, was the one that showed most similarity to the ‘scagliola map’ and was therefore used as the example to copy.

It was possible to remedy the most disturbing lacunas. Attempting to go further and completely inpaint all losses would, arguably, make the treatment...
more an interpretation than an accurate reconstruction and was therefore judged unnecessary.

Out of concern for the fragile state of the scagliola top, it was decided to back it with a light-weight honeycomb panel. We expected that the increased supporting surface would diminish stress within the scagliola. A 28 mm thick backing panel was adhered to the underside of the top with patches of silicon paste. (Locally applied Paraloid B72 in acetone served as a barrier layer between the silicon paste and scagliola.) To avoid a disturbingly visible addition, a rebate was cut in the edge of the lightweight panel which then could fit within the table frame and thus, the top visually retained its original thickness and contour. By replacing the stone slab support by a light-weight backing panel the total weight of the top was significantly reduced and an important threat to the stability of the support had been removed.

The tops of the four Brühl console tables by Jacques that are in private ownership have survived in a much better condition than the Amsterdam top. The gloss of their surfaces and their vivid colours are a useful reminder of how these can be factors in the legibility of the trompe-l’oeil imagery and how these can influence the aesthetic appearance. An attempt was therefore made to restore some of the old sheen by the application of a coat of micro-crystalline wax. It was clear from the outset however that this could never undo the severe scratching and uneven re-gluing in our table.

Support

Cleaning

Removal of the dark brown top layer was carried out according to the procedure described above. On exposed areas, where the older layers had worn off, the adhesion of the dark brown top coat was much better and it was consequently harder to remove (claw-and-ball feet, surfaces directly adjacent to earlier repairs).

The result of this laborious mechanical picking and scraping was a significant improvement of the look of the stand; the wood grain could once again be appreciated. The original transparent varnish coating needed just a thin application of beeswax to regain saturation and gloss.

Disassembly

Treatment of the construction of the stand commenced by dismantling the misaligned parts. All hardware that held them together was removed. The variety of nails and screws that had been used forms an account of the date and origin of the repairs. Superfluous glue remnants were removed with solvent (gels). Epoxy bonds have were broken mechanically by cutting and by scorching with a hot spatula or a soldering iron which softened the polymer enough to be scratched and peeled away.

Structural reassembly

Positioning of the incomplete fragments correctly would involve a certain amount of guesswork as
the correct curves and shapes could no longer be derived by merely holding the pieces together. Here, tracings of the contours or wooden jigs made from the opposite leg or stretcher were often a useful guide to establishing the original position of fragments. The comparative size and shape of an opposite leg and stretcher were then used for reference. Also, the continuous curves within the leg or stretcher itself helped to define the position of the detached pieces. When the exact position of loose parts had been established, new cypress wood would be added wherever necessary to compensate for losses. Fitting the new wood to old surfaces of breaks was done with the help of carbon paper. This served to transfer the relief of the old surface onto the new wood which was then gradually trimmed away to form a negative of the old surface. After aligning the parts, they were either glued with hot animal glue or with carvable epoxy paste. When the fit of a joint was not precise enough or if the load on a particular joint was high, epoxy was the adhesive of choice. To ensure reversibility, the faces of the glue joints were first coated with an easily removable barrier layer of hide glue. For assembly of the legs and stretchers, the partly reconstructed original mortise-and-tenon joints could be re-used. Former screw and nail holes were used to accommodate bamboo pins, glued in, to reinforce fragile parts and joints. Small cypress wood plugs were put in on the surface to hide the bamboo pins. Small losses/flaws were filled with gesso and retouched. Any losses of the carvings were compensated with new wooden inserts which were then re-carved. The new cypress wood was toned with a bitumen solution, then colour matched and finished with amber varnish and a coat of wax. The objective was to reach a uniform saturation and gloss of finish whilst preserving the original varnish.

**Conclusion**

A large part of this conservation treatment was essentially concerned with the re-treatment or mitigation of earlier repairs. The scagliola trompe-l’oeil picture can be appreciated much better after cleaning, retouching and refinishing. Since this object typically invites scrutiny at a close range, details matter. To allow such close inspection, the table is now exhibited in a sturdy transparent showcase. There was no deadline for this treatment, which gave us ample opportunity to find out about the most feasible treatment options. The investment in time - some 630 hours were spent on the treatment alone - was deemed to be warranted by the historical, aesthetic and artistic importance of the object.
Acknowledgements
We wish to thank Suzan de Groot, Henk van Keulen and Luc Megens (Cultural Heritage Agency) for the analysis of the constituents of the scagliola table top.

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Notes
1 Measurements of top: depth 480 mm, width 945 mm, thickness 43 mm (after treatment ca. 32 mm) and of stand: height 670 mm x width 875 mm x thickness 470 mm.
2 Made by Adolphe Jacque, Bonn 1761.
3 Four more tops of similar form have survived in a private collection. They are dated 1757-1758 and signed Adolph(e) Jacque and supposedly were made for the castle Augustusburg, Brühl of Elector Clemens August. (Kurfürst Clemens August, Landesherr und Mäzen des 18. Jahrhunderts, Ausstellung in Schloß Augustusburg zu Brühl, Verlag M. DuMont Schauberg: Köln, 1961.) A fifth, larger and rectangular top dated and signed Adolphe Jacque à Bonn 1760, is in the Westfälisches Landesmuseum für Kunst und Kulturgeschichte, Münster (Inv. nr. K 194 LM). It has been argued this work also once belonged to the collection of Elector Clemens August. See B. Meier, ‘Mitteilungen des Landesmuseums’, in: Westfalen, Hefte für Geschichte, Kunst und Volkskunde 5, 1913, pp. 62-64. We thank G. Dethlefs, curator of the museum, for this information. The building and interior decoration of the Augustusburg palace was a large-scale project which took decades to complete and numerous craftsmen and artists were involved. The Rococo interiors were decorated for instance by Italian stucco workers who produced the much admired reliefs and three dimensional sculptures, and they also made the colourful marble imitations in plaster. Designs are attributed to Johan Adolf Biarelli, the stuccowork was done by Giuseppe Artario, Carlo Pietro Morsegno, Joseph Anton Brilli.
4 R. Baarsen (ed.), Rococo in Nederland, Waanders; Zwolle, 2002, pp. 22-23. S.A.C. Dudok van Heel writes that in 1785 the inheritance of Herfst and his wife was divided amongst their three children. The house was left to his son Michiel, and
Dudok van Heel believes that the table went to him as well. Since Michiel Herfst didn’t have any children Dudok van Heel believes that the table was sold after his death by his inheritors to art dealers or brokers that were active in Holland in the early nineteenth century. This might be how it came to Britain. A descendant of Charles Tennyson d’Eyncourt (1784-1861), owner of the now demolished Bayons Manor in Lincolnshire sold the table at auction in 1996. See: ‘Een trompe l’oeil van Singel 397’ in: Amsteladamum 86 (1999), p. 5.

5 Recently successful businessmen like Herfst, who belonged to the religious minority of Lutherans in the Netherlands and who was born from immigrant (German) parents would typically have difficulty to enter the circles of the eighteenth-century Amsterdam regents’ class. Non-withstanding their wealth, men like Herfst remained outsiders who were excluded from office in the city government. This may explain why he turned to the regents’ opponents and sided with the royalist faction.

Comparing measurements of the width of the facade or the pier walls of the house in the drawing to the real building gives a scale of c. 1:12.


In the second Ante room (Room 46) of Augustusburg an Emperador marble fireplace stands of which the late Rococo decoration on the frieze shows some similarity to the Amsterdam support. I. Glade, Die kurfürstliche Marmorkamine des 18. Jahrhunderts im Schloss Augustusburg in Brühl, Tectum: Marburg, 2014, pp. 108-111.


R. Baarsen, De Amsterdamse Meubelbouwers en de geschiedenis van de meubelmakerij in de tweede helft van de achttiende eeuw, Waanders Uitgevers: Zwolle, 1992 17, 63

After separating the top from its backing plate during treatment we found deep scratches and a couple of drilled holes in the coarse mortar of the top. These were possibly meant to improve adhesion.

During treatment 628 g of metal was removed, which consisted of iron brackets and braces, wire nails and forged nails or screws (both nineteenth-century and modern). It was obvious the hardware had been placed and refitted by more than one generation repairers.

To the extent that it proved too hard to identify for the auctioneers, who described it as walnut.

The reason for the local application of what seems to be a varnish is not clear; was it applied by the maker or is it a result of some later treatment? Was it intended to enhance gloss or perhaps to protect against soiling from the adjacent areas when polishing the surface?

Microscopical features were used for wood identification with the multiple entry identification key GUESS. See E. Wheeler et al. (editor), Computer-Aided Wood Identification, North Carolina State University, Raleigh: September 1986, Bulletin 474. The identification was then checked against references in F.H. Schweingruber, Anatomy of European woods, Verlag Paul Haupt: Bern and Stuttgart, 1990, pp. 136-137.

Materials and suppliers, recipes
- Golden acrylic paint: Van Beek, Amsterdam
- Amber varnish, hide glue, micro-crystalline wax (mixture of paraffin and Cosmoloid wax in white spirit): Kremer Pigmente
- Schmincke water colour paint: Van Ginkel, Amsterdam
- Bitumen solution: Droguérie Le Lion, Brussel
- Carbopol 934, Ethomeen C-25, Shellisol D60, xylene, Triton (x-100): Fischer Science (www.fishersci.nl)
- Carvable epoxy for wood repairs: Fa. Bok, Amsterdam Cold setting fish glue: Laverdure & fils, Paris
- Cypress wood: Fijnhout B.V., Amsterdam
- Demineralised water
- Gesso (chalk, hide glue)
- Gypsum, dental: Silky Rock, www.dentco.nl
- Honeycomb panel, 28 mm. Aluminium honeycomb, skins: glass fibre impregnated with epoxy resin: CEL Components S.R.L., Villanova di Castenaso, Italy
- Modostuc (composition: chalk, kaolin, polyvinyl acetate and an acrylic ester), Paraloid B72, pH neutral polyvinyl acetate glue: Labshop (www.labshop.nl)
- Sikaflex paste-MS polymer: SIKA Nederland B.V., Utrecht

Holzarbeiter-Verbandes G.m.b.H., 1924, p. 334
P Vierl, Putz und Stuck, 1987

Microscopical features were used for wood identification with the multiple entry identification key GUESS. See E. Wheeler et al. (editor), Computer-Aided Wood Identification, North Carolina State University, Raleigh: September 1986, Bulletin 474. The identification was then checked against references in F.H. Schweingruber, Anatomy of European woods, Verlag Paul Haupt: Bern and Stuttgart, 1990, pp. 136-137.

See http://www.oldmapsonline.org

Belgium Foederatum-Marianus Joseph 1730-1770
Belgica Foederata Complectes Septem - Tobias Conrad Lotter 1760-1770
Belgii Pars Septentrionalis - Johann Baptist Homann 1730-1770
Belgium Foederatum - Seutter Matthias 1740-1760

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- Sikaflex paste-MS polymer: SIKA Nederland B.V., Utrecht
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- Rob Versluis (AHM); figures 14, 15, 16
  http://www.wazamar.org/Nederlanden/
- VIIprovin1773/VII-prov-kaarten.htm; figure 33
- If not mentioned otherwise, the authors.
The conservation of a vinyl-upholstered chair: PVC degradation and conservation

Aura Colliander

Abstract
This paper is based on a case study of an Artek chair dating from the 1950s and it deals with the composition and conservation of the original vinyl-coated upholstery fabric. Vinyl – short for polyvinyl chloride or PVC – fabrics came onto the market in the 1950s as an imitation material of leather that would eventually replace the cellulose nitrate-based Pegamoid. Vinyl had properties exceeding those of genuine leather, which made it an ideal material for the upholstery of furniture especially situated in public spaces. The composition and the production of vinyl-coated fabrics are discussed in this paper, as well as the degradation and conservation of PVC. The degradation of PVC on the Artek chair upholstery was to an extent visible to the naked eye – tears and the surfacing of the phthalate plasticizer that had changed the appearance of the plastic. The treatment of the vinyl included surface cleaning and removal of the oily plasticizer from the surface, lining tears and filling holes of the vinyl with a fill made from the mixture of synthetic resin, glass microballoons and pigments. The optimal storage conditions of the Artek chair were determined, since preventive conservation is a more efficient way to conserve plastic than any active conservation. In this case study the contradicting storage recommendations of the two synthetic materials of the chair – the vinyl upholstery and a cellulose nitrate varnish – led to a compromise of storage conditions.

PVC
PVC is a thermoplastic that is polymerized from the vinyl chloride monomer. The polymerization of PVC was done for the first time in 1872, but the wide possibilities of the usage of PVC were only discovered in the early twentieth century by the addition of a plasticizer. PVC on its own is a very rigid and unstable material that is difficult to handle and, therefore, a plasticizer is often present. The plasticizer increases the flexibility of PVC by separating the polymer chains from each other and forms the PVC into a plastic with versatile properties. From the 1950s onwards, the most commonly used PVC plasticizer was di(2-ethylhexyl) phthalate, DEHP, which later proved to be harmful and was replaced by other varieties. The properties of PVC are further shaped with other additives, such as UV stabilizers, fills and pigments. PVC has been listed as one of the most unstable materials in museum collections along with cellulose nitrate, cellulose acetate and polyurethane because of its rapid degradation. PVC is very sensitive to the yellowing effect of UV radiation which makes PVC degrade rapidly when exposed to light and heat. Already at its production begins the autocatalytic degradation process of PVC. Free radicals are formed in PVC in the presence of heat, impurities and UV radiation, leading to the polymer to oxidize. The oxidation instead creates further free radicals. This cycle continues until practically the entire polymer has degraded. Simultaneously, the polymer chains of PVC break caused by the oxidation of PVC, which leads to the decreasing of the molecular weight of the PVC polymer. A decreased molecular weight increases the softness of the plastic and decreases its tensile strength.

Vinyl fabric – composition and fabrication in the 1950s
Initially an invention for the army during the Second World War, PVC-coated fabrics became accessible for consumers in the 1950s and they started to replace the earlier versions of imitation leather, such as the cellulose nitrate coated Pegamoid fabric. Vinyl-coated fabrics were first produced as solid vinyl – non-expanded coatings on...
closely woven fabrics – and later the expanded vinyl coating was developed.9 Cotton was used as a base-fabric in the early decades of vinyl fabric production and was later replaced by synthetic fabrics.10

The solid vinyl coating is achieved by spreading a mixture of PVC, liquid plastisol and other chemicals on a textile fabric that then passes through an oven (figure 1). The texture on the surface of the vinyl fabric is then created with embossed rolls.11

As a composite material a PVC-coated fabric is very resistant to wear and tear. The base-fabric maintains the form of the coated fabric and prevents warping. The PVC coating instead determines the chemical properties of the fabric by, for example, making the fabric impermeable to dust particles, liquids and gasses. The PVC coating also improves resistance to abrasion.12 Due to these properties vinyl fabrics gained popularity from the mid-twentieth century, especially in the upholstery of furniture in public spaces and car seats – they could easily be cleaned and were resistant to abrasion. Initially, what was a cheaper substitute of leather eventually became a valued material of its own. This has led to vinyl-coated fabrics being fabricated in all colours and textures, which intention is no longer to imitate the genuine leather.

Design and provenance of the Artek chair
The vinyl upholstery that was examined and conserved in this case study is from a Finnish design chair, an Artek chair no. 62 (figures 2a, b, c). According to the drawings of the chair model no. 62 from 1938 the design was made by Aino Aalto, but often the furniture design was a collaboration between Aino and her husband Alvar Aalto. When designing upholstered furniture the designer Maija Heikinheimo was often involved as well.13 The design of the model no. 62 chair follows the style of Alvar Aalto – the birch legs are bent to a curved shape using thin lamellas. This method of bending wood was Alvar Aalto’s trademark and led to the establishing of Artek in 1935.

The chair no. 62 that is the object of this case study belongs to the collection of the Alvar Aalto Museum in Jyväskylä, Finland. Even if it only dates from the previous century its provenance is not well known. It was donated to the Alvar Aalto museum in 2014 by the furniture factory Huonekalutehdas Korhonen Oy, which had began a collaboration with Alvar Aalto before the establishing of Artek. This factory was manufacturing Artek furniture until 2014 when the factory was sold. The selling of the factory led to some pieces of furniture being donated to the Alvar Aalto Museum. When the chair was donated to the museum all information of its previous use and the time of its manufacturing had been forgotten. Although, it can be assumed that the chair had been manufactured at the same furniture factory that donated it and perhaps originally the chair had been included in its public space interiors.14 The manufacturing of the chair no. 62 started after
1958 and continued for several decades. The Artek chair to be conserved was dated to the 1950s due to the materials and the structure of the chair. The number of lamellas that the bent birch legs were constructed of indicated that the chair had been manufactured in the 1950s at the latest. The vinyl upholstery was an original one and could not date to decades prior to the 1950s since vinyl-coated fabrics only became accessible for consumers in the early 1950s. This information indicated that both the chair and its upholstery dated from the 1950s.

Examination

The identification of the plastic is the key to all plastic conservation because the chemical properties of the plastic material are complex and so might be their compatibility with conservation materials. The coating of the imitation leather was first examined externally, and by comparing it with archival data of Finnish vinyl products, which indicated that the coating was most likely PVC. The FTIR spectra of a sample taken from the imitation leather was then compared with a reference sample of plasticized PVC to ensure that the coating was PVC (figure 3). The base-fabric was identified under microscopy as cotton (figure 4), which was the typical base-fabric of vinyl coated fabrics in the 1950s. The close-up of the vinyl surface (figure 5) shows the grain of the vinyl on the Artek chair. The texture is not intended to imitate genuine leather but instead the thin vertical and horizontal lines give a softer look to the otherwise flat and shiny surface of vinyl.

The structure of the upholstery of the Artek chair was studied and documented (figure 6) and no synthetic material had been used for the underlying
The conservation of a vinyl-upholstered chair: PVC degradation and conservation

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The underlying layers of the upholstery were not in need of conservation and, therefore, were left intact.

Condition of the vinyl

There were no signs of previous restoration or reupholstering of the chair. Instead, the condition of the chair gave an insight into its neglect in the past years and decades, either being stored in poor conditions or even having been used as a ‘workbench’ at the furniture factory.

The vinyl upholstery showed slight signs of the deterioration of the plastic. A sticky surface had formed onto the top of the back support and a thick layer of dust had stuck to it (figure 7). The emigrating plasticizer was also visible as a white bloom on the lower parts of the back support. Also, areas where no stickiness was recorded were full of dust and stains of paint and dirt. There were numerous scratches on the vinyl, most of them matte lines on the surface of the vinyl and a few cuts penetrating through the entire vinyl coating. The matte surface scratches could be found on all sides of the vinyl upholstered seat and back support, and the deeper cuts especially in the front of the seat where most of the abrasion had occurred.

The structure of the chair was very unstable and had caused the back support to come loose from the back upright so that it was only attached to the chair by the upholstery. This had caused excessive stress on the vinyl upholstery and consequently both the vinyl coating and its base-fabric were torn 1-2 cm on both sides of the back uprights. The vinyl upholstery also had two large holes in both top corners of the back support which seemed like the chair had been dragged against the floor causing the holes and the surrounding areas of vinyl to deform and loose the shiny embossed surface. The lining fabric and the flock beneath it were visible through these two holes.

Treatment of the vinyl upholstery

The vinyl fabric of the Artek chair was cleaned using distilled water, and ethanol was added to remove the oily surface caused by the emigrated plasticizer. The removal of the emigrated plasticizer is not always necessary since it may cause further degradation of the PVC, but on the vinyl fabric of the Artek chair the removal of dirt and grease layer was considered the best alternative for aesthetic reasons. Ethanol may cause the molecular weight of PVC to decrease and therefore its use on PVC should not be a decision taken lightly.

The two large holes in the vinyl of the back support were filled. Because the vinyl around the two holes had become deformed and matte, a new type of fill material for PVC had to be established, one that would imitate the damaged vinyl fabric. A silicone mould could not be used in imitating the texture of the vinyl surface since the size of the area to be filled was greater than any existing area with the same type of damaged vinyl texture. Instead, a patch was prepared with Reemay polyester non-woven fabric where a mixture of Laropal A81 together with dry pigments and hollow glass microspheres used as a filler were added. The fill material could be eas-
ily modified to imitate the sheen of the matte vinyl surface well (figures 8a, b). The fill patch was then applied to the backside of the vinyl fabric. The tears were lined using the Reemay fabric. The choice of adhesive was made considering that it had to be compatible with PVC, since the lining would not only be in contact with the underlying cotton fabric of the imitation leather but also with its vinyl coating. A 1:1 mixture of the acrylic adhesives Lascaux 404 HV and 398 HV was used to adhere the Reemay to the backside of the vinyl (figures 9a, b). During the treatment the appearance of the Artek chair went through a major change. Once the tears and holes were no longer visible and the surface of the vinyl had been cleaned the chair recovered the aesthetics of a piece of design furniture (figures 10a, b).

Preventive conservation and safe handling

Since the degradation of the plastic material can’t be stopped but only slowed down by optimal storage conditions the preventive conservation measures are especially important in the conservation of plastics. The right storage conditions are a more efficient way of conserving the plastic than any active conservation treatment.15 PVC is best preserved in a hermetic glass container where it is protected from UV radiation. Another option is to store it inside a bag made of polyester.16 It is likely that a new sticky surface of the migrating plasticizer will form on the surface of the vinyl in the future even if it is once removed. The sticky surface does not necessarily have to be removed if the chair is stored in such a way that dust cannot stick to the surface.17 The vinyl should not be in direct contact with other objects because the migrating plasticizer of PVC could attach to other objects. It also should be ensured that a protective textile on top of the vinyl does not stick to the oily vinyl surface. A suitable protection that can be in contact with the vinyl is a silicone-coated polyester Melinex film, which does not stick to the vinyl. PVC should, however, not be protected with fabrics made of polyethylene since it absorbs the phthalate plasticizer from the PVC.

The wooden parts of the Artek chair are varnished with a cellulose nitrate lacquer. This has very different storage requirements compared to those of PVC. Storing the Artek in a hermetic box or bag is out of question since cellulose nitrate lacquer finished objects should be stored in a well-ventilated space due to the vapors that the degrading cellulose nitrate releases.18
Low temperatures protect the plastic from degradation. The optimal storage condition for both the vinyl and the cellulose nitrate lacquer of the Artek chair are at a temperature below 20 °C and stable relative humidity around 50%, protected from UV radiation. Storing the chair in complete darkness would be optimal, and the maximum exposure to light should not exceed 50-100 lux.19

PVC objects dating from the 1950s to 1970s must be handled with caution because of the phthalate plasticizers that have been commonly used during those decades. These plasticizers can be absorbed through skin contact and, therefore, museum professionals and conservators should wear gloves while handling these objects.20

**Final words**

The conservation of plastics is a growing field of conservation. This paper is one take on the conservation of PVC and serves as a reference for similar conservation cases. More research and long-term monitoring is needed to establish conservation methods for degrading PVC. This article is based on the author’s bachelor’s thesis in furniture conservation at the Helsinki Metropolia University of Applied Sciences in May 2016.

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**Notes**

5. Y. Shashoua 2008, pp. 70, 162.
Photo credits

All photos were taken by the author unless stated otherwise.
Filling losses in granite linoleum with Beva 371

Julia Kun

Introduction
At the beginning of the twentieth century, when a higher awareness for the need of hygienic living conditions arose, linoleum was increasingly applied to a wide variety of furniture and interior surfaces. For highly resistant furniture covers the so-called granite linoleum was often used. This is a patterned linoleum with a speckled top coating which may consist of different colour combinations (like a granite stone). Today, granite linoleum is not produced anymore. This leads to conservation challenges when filling losses in granite linoleum. Within the context of a study project and a seminar about putties, techniques were developed which utilise the thermoplastic material Beva 371 as a highly flexible putty to fill losses in granite linoleum.

One project involved the treatment of a kitchen table dated to the late 1900s which had large losses within its granite linoleum covering. The restoration aimed to the complete and visually harmonisation of the surface. This was achieved by introducing a neutral-coloured putty made of Beva 371 which was modified to show a similar texture and haptic properties to the original granite linoleum. The fills provided the desired integrity to the surface, while remaining distinguishable as such.

The second project demanded the complete visual reconstruction of losses in granite linoleum. In addition to the first approach chips of Beva 371 were coloured to match the original linoleum and thermoplastically formed into inlay films. By modifying the additives, the pigment composition, and the form and size of the Beva 371 chips, it is possible to create a convincing surrogate for granite linoleum.

After a brief overview on the historical development and usage of granite linoleum in furniture, particularly in German-speaking areas, this paper describes the two filling techniques step by step and reflects on their benefits and challenges.

Definition of linoleum
Linoleum is classified as a modified natural material. It belongs to the plastic precursors of the nineteenth century that aimed to imitate other materials using natural resources. The name is derived from Latin: linum, meaning flax, and oleum, meaning oil. Accordingly, it is a composite material in which a coarse-meshed jute fabric is laminated with a cover layer of a linoleum mass (figure 1). This mass consists of a mixture of linoxyn and resins;

Figure 1: Granite linoleum in cross-section (Tischgranit (table granite), 1.4 mm thick, sample of Deutsche Linoleum-Werke (DLW), in a sample catalogue for furniture and wall linoleum).
for example, the brittle resin kauri copal (for hardness and durability) and the soft resin colophony. It can achieve different decorative and functional properties by adding cork powder and/or wood powder, and pigments and dyes. A coating, usually made of wax, was used to protect the covering against mechanical load. Synthetic resins (e.g. acrylates) were later used for this purpose.

Launch as flooring

Linoleum was patented in 1863 and was the most successful material for interior fittings around the turn of the century. Low production costs and superior properties enabled a wide distribution: linoleum’s closed smooth surface is hydrophobic, hygienic, anti-bacterial, jointless, easy to clean, poorly flammable, elastic, noise-attenuating, warm to the feet, decorative, durable, inexpensive, economic, and recyclable. Thus, linoleum succeeded in replacing its precursors, such as oilcloth or the expensive rubber-based Kamptulikon (figure 2). In the beginning plain-coloured, natural-brown floorings were mostly produced. In the last decades of the nineteenth century and in the beginning of the twentieth century linoleum often served as a surrogate to imitate splendid oriental carpets, elaborate parquetry, stone, or tiles. Later, linoleum increasingly found recognition as an independent material and became a material used for modern design ideas. New colours and forms (floral patterns, borders, ornaments) emerged, with the participation of major architects, designers and artists, such as Lucian Bernhard, Hans Christiansen, Carl Eeg, Albert Gessner, Josef Hoffmann, Albin Müller, Bruno Paul, Richard Riemerschmid, Henry van de Velde, and especially Peter Behrens.

From the 1920s onwards, plain-coloured linoleum, also known as Uni Walton after its inventor, became a popular material among architects such as Bruno Taut, Walter Gropius, and Ludwig Mies van der Rohe for colourful floors, stairs, walls and furniture.

The use of linoleum for furniture by the middle of the twentieth century

The first use of linoleum on furniture cannot be precisely determined. However, this innovation in furniture ran parallel to the development of the kitchen. Previously, oil cloth was used for highly stressed surfaces; now, almost only linoleum was applied. Knowledge about the emergence and spread of diseases gained in the last third of the nineteenth century led not only to changes in medicine but also to new demands for housing and kitchen equipment. Work surfaces had to be resilient and hygienic. Linoleum and rubber coverings, as well as glass plates and marble were frequently recommended. Advisors for households and welfare organisations emphasised the importance of hygiene, but the manufacturers of linoleum also advertised their products as hygienic furniture coverings (figures 3, 4).

Leading designers took advantage of the excellent properties of the material (‘the rich shades,
the insensitivity (...), its washability, its hygienic properties and its low price (...).19 They participated in the improvement of housing and living situations by using new insights regarding hygiene and designing furniture with linoleum.20 In the 1920s and 1930s, designers like Marcel Breuer, Erich Dieckmann, Walter Gropius, Paul Griesser, Franz Schuster, and Margarete Schütte-Lihotzky showed multiple application possibilities of linoleum in their furniture designs.21 By combining harmonious contrasting colours and cube shapes with smooth surfaces they created discreet modernist furniture. Generally, the furniture’s surface was made of light woods or bright paints on wood, with the colours of the linoleum in dark tones. However, the strong, dark tones for paint and wood were also used with light linoleum for contrast, usually.22 The use of the material prevailed until the 1950s/1960s, especially for kitchen furniture but also other furniture types. Since the 1990s, linoleum has been rediscovered as a material for furniture by some well-known designers.

Granite linoleum and the special type ‘Tischgranit’
The fabrication of granite linoleum began in England in 1879, and in Germany in 1891.23 The material was used for floors, furniture, and walls (figures 5-10). Today, this linoleum type is no longer produced24 due to the complexity of its fabrication. Production was discontinued in the 1950s.25 Granite linoleum is a patterned covering in which the linoleum mass is dyed.26 The name and look are derived from natural granite stone, whose pattern is irregularly speckled. There were different colour combinations, with two to five similar or strongly contrasting shades.27 Granite linoleum was known for its durability, because the grained mass was minimally susceptible to soiling or abrasion.28 ‘Tischgranit’ (literally translated as ‘table granite’) was a special type of granite linoleum used for furniture29. It was used as a durable and easy-to-clean surface covering for furniture and was often applied to kitchen tables, chairs30, stools, cupboards and sideboards, desks, drawing tables, as well as counters and tables in the dining area.31 In addition to granite linoleum there were also plain and patterned furniture linoleum (e.g. Uni Walton, Jaspé).32 However, granite linoleum was almost entirely used for kitchen furniture.33 Because of the low wear of the various types of furniture linoleum, it was usually produced in a relatively thin thickness of 1.7 mm;34 further fabrication thicknesses ranged from 1.4 to 2.2 mm.35
Unlike floor coverings, table linoleum did not receive a water-repellent red primer of oil paint on the back during the fabrication. It was pasted directly on the furniture without protective coating.

**Fixing linoleum to a tabletop**

Fixing linoleum onto furniture (figures 11-16) is described as a simple procedure in historical sources. First, a completely smooth surface was created by filling joints and bumps in the wooden tabletop (the filler used is unknown). Then a paste made mostly from rye flour was evenly spread over the surface. The paste had to be very viscous, with little water, for better handling with a spatula. The rolled linoleum was unrolled starting from one side (with an excess length of ca. 1 cm on every edge) and was firmly pressed on the tabletop by hand. The surface was weighted with iron plates or similar aids until the paste had set, which was the case after six hours. Then, the linoleum was...
cut flush along the edges of the table with a knife. As the last step the table edges were covered with nailed wooden strips. The strips were levelled with the top edge of the linoleum. This method was also used to apply linoleum to sideboards and other kitchen furniture, such as trays. (figure 17).

Case study
The treated object is a kitchen table from the late 1900s – and also a mass-produced product during the early twentieth century in Germany (figure 18). The tabletop’s granite linoleum shows a pattern of mint green and black speckles of different sizes evenly distributed in a petrol-coloured ground (figures 19, 20). The linoleum covering mass is filled with wood powder, which was identified in a cross section (figures 21, 22). The wood fibres are also perceptible to the naked eye.

Two major types of losses defined the linoleum’s condition: losses of the linoleum covering mass where the ground texture was exposed, and the complete absence of the linoleum (figure 23). Most losses emerged from the edges of the tabletop. A particularly large loss area was about 40 cm wide over the total tabletop width of 69 cm.

The conservation proposal involved the consolidation and cleaning of the linoleum and the comple-
tion of losses by applying a neutral filling mass which fitted visually with the heterogeneric granite linoleum. Retouching should be avoided.

**Fill mass with solvent-free Beva 371**

Various binders and fillers with different concentrations were tested in advance, including some already utilised within conservation science and practice. The binders were determined according to the results of Ellerman 1999, Kühn 2004, Stockhorst 2007 and Tauss 2007. Acrylates and PVACs such as Vinnapas EP 17 (or Airflex EP 17), Plectol D 498 or B 500 and Lascaux 498 H are recommended. It should be noted that the focus in these theses was on floorings: the fill masses had to show a very high elasticity and resistance to tension and pressure loads. In this case study, however, the visual appearance was a key decision criterion. For the preliminary tests, Vinnapas EP 17, Vinnapas XD 05, Plectol B 500 were utilised.

For the first time, the thermoplastic deformable material Beva 371 (ethylene vinyl acetate copolymer, cyclohexanone resin, phthalate ester of hydroabietyl alcohol, and paraffin wax) was tested. The material was chosen with regard to the good experiences with Beva 371 fillings gained so far in conservation practice. Because of its good workability with heat and solvents, and a number of further good properties (see below for benefits and challenges), Beva 371 allows a versatile application.

The pure binder is obtained by evaporating the solvents (at 50 °C, ca. 5-7 days) from the commercially available Beva 371 solution (figure 24). The solvent component (toluol, white spirit) within the solution is not desired for the putties, as it leads to a loss of mass or shrinking in the filling during drying. Moreover, during cleaning tests on the granite linoleum a white surface haze was formed on the linoleum with 100-140 °C petroleum spirit. Even if the use of aliphatic and aromatic hydrocarbons was possible with aged linoleum the limits of solvent use were shown here.
The fillers were also selected according to the results of the aforementioned authors, who recommend cork powder (medium and fine grains, Ø 1.0 mm and 0.2-0.5 mm) and scrap powder (figures 25, 26). The latter is a linoleum powder produced by the Deutsche Linoleumwerke (DLW Flooring GmbH). For more than 100 years, linoleum manufacturers have recycled their own linoleum waste generated during fabrication. The waste is sorted by colour, crushed, ground, and then reintroduced into the production process. Linoleum powder is available in different shades. In this case, a light brown powder (‘nature’) was utilised. In addition to these filler materials microballoons (phenolic resin spheres) were also tested.

With regard to mechanic workability (cutting, sanding) good results could be achieved with almost all putties, except the acrylate and PVACs in combination with microballoons. The acrylate and the PVACs in combination with linoleum powder and cork powder mostly showed poor shrinkage behaviour and adhesion. Beva 371 was stable with all fillers, as expected. The microballoons were finally excluded because a subsequent retouching would have been necessary.

The best result used a recipe consisting of Beva 371 (1.0 g), fine cork powder (Ø 0.2-0.5 mm; 0.7 g), and linoleum powder (0.3 g). The high flexibility of Beva 371 in combination with the fillers could be utilised to develop fills with very similar optical properties to the original material. The fillers had a positive effect on the appearance of the fill mass. The cork powder yielded a slightly rough surface similar to the linoleum of the kitchen table while the linoleum powder produced a lightly heterogenic appearance because of its differently-coloured particles.

**Pigment mixture**

In the following step a standard formula was determined for the petrol-coloured basic tone of the linoleum. Different films made of pure Beva 371 and pigments were produced and compared to the original (figure 27). For this purpose the Beva 371 was heated to temperatures between 100 and 120 °C in a melting pot and pigments were added. Relatively small amounts of pigments can be used to colour the viscous mass. The adjusted pigment mixture was added to the brown fill mass (figure 28). As the colour of the original was not homogeneous due to ageing and use, the filling material was adjusted with further small pigment additives to visually match different losses (table 1).

**Filling technique**

The self-produced Beva 371 putty films were utilised for the fills. The coloured putty was pressed into a film between a preheated PMMA sheet and a hot plate (both at ca. 100 °C). Two siliconised Hostaphan films were used as separating layers. The putty films were fixed into the losses with a heated spatula and processed further using mechanical action and with solvents.

### Table 1  Empirically determined recipes of a neutral filling.

<table>
<thead>
<tr>
<th>neutral filling (for petrol coloured granite linoleum)</th>
<th>mixing components in melting pot</th>
<th>grinding mixture with mortar and pestle</th>
<th>adding additives to heated coloured fill mass in melting pot</th>
</tr>
</thead>
<tbody>
<tr>
<td>uncoloured fill mass:</td>
<td>solvent-free Beva 371 (1.0 g)</td>
<td>(ca. 100-120 °C) with a glass rod or a spatula</td>
<td></td>
</tr>
<tr>
<td></td>
<td>linoleum powder (0.7 g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cork powder (0.3 g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 : 1 parts by weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pigment mixture:</td>
<td>0.4 g chromium oxide hydrate green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 g Cassel brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.04 g bone black</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.02 g titanium white</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.01 g Indian yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>coloured fill mass:</td>
<td>0.5 g uncoloured fill mass: 0.1 g pigment mixture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pigment additives:</td>
<td>little amounts of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(for visually matching of the respective loss)</td>
<td>chromium oxide hydrate green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cassel brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bone black</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>titanium white</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian yellow</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 29 Loss before treatment.

Figure 30 Fixing a small piece of film and scraping the glossy surface.

Figure 31 Brighter tone after scraping.

Figure 32 Deepening the surface with Shellsol T.

Figure 33 Colour after treatment (dried condition).

Figure 34 1. Layer unfixed in loss.

Figure 35 2. Layer fixed in loss with heating spatula at 90-100 °C.

Figure 36 1. Layer unfixed in loss.

Figure 37 2. Layer fixed in loss with heating spatula; also possible: warming the film and pressing in loss with a preheated PMMA sheet.

Figure 38 Colour of filling after levelling with scalpel.
Filling losses in granite linoleum with Beva 371

Testing the colour

Before a putty film was inserted into a loss it was examined for its colour match (figures 29-33). A small piece of film was spot-fixed into the loss with a heated spatula (at ca. 80 °C) and a separation layer of a siliconised Hostaphan film. The film was then scraped with a scalpel to uncover its fillers and to matt the very glossy surface. This resulted in a lightening of colour, which had to be deepened again to better match its surroundings.

The fastest and most gentle technique for adjusting the colour besides reheating was the use of solvents, especially Shellsol T, which was applied with a cotton swab. Using this technique, the overall colour, texture, and gloss of the putty were now appropriate for the fills, with minor tweaks applied for different fills. Finally, the test putty could be peeled off after quickly heating it with a heated spatula or a hot-air fan.

Filling a small loss

After colour matching the fill was ready for its implementation (figures 34-39). The putty film was roughly cut to the shape of the loss and pressed into the void with a heated spatula (at 90-100 °C). A hot-air fan can help to soften thicker Beva 371 films, allowing for easier further processing. Additionally, thick films can be preheated on a heating plate before introducing them into the loss.

Due to the high filler content and the resulting increased hardness of the filling the putty had to be processed at higher temperatures in comparison to pure Beva 371 or Beva 371 with a little amount of pigments. In this case, temperatures of 90 to 100 °C were necessary to achieve the desired ductility, compared to temperatures of 65 to 80 °C for pure Beva 371.

Near the edges of the losses this intervention had to be carried out very carefully in order not to expose the linoleum to increased temperatures and thus accelerate the ageing process. A preliminary test on an aged green granite linoleum piece (from a counter of a merchant shop at the turn of the nineteenth century) showed that it tended to yellow at temperatures above 120 °C.

Because of the thickness of the original linoleum covering mass the putty was inserted in two or three layers to ensure sufficient adhesion to the substrate. After pressing the putty into the loss a thin Beva 371 film was laid on the surrounding original area and the filling. Excess material was levelled with a scalpel, or a cranked chisel for larger areas. After adjusting the brightness with Shellsol T the fill mass was very well integrated into the original surface.

The putties were deliberately coloured slightly lighter than the original to allow later fine-tuning of colour both in the editing state and once the putty is aged. In some cases a discreet retouching was implemented with highly diluted watercolours. The paint was applied with a glazing technique and also dabbed with a soft cotton cloth.
Filling a large loss

The largest loss in the linoleum posed a particular challenge due to its size (figures 40-42). It required finding a neutral basic tone for the divergent colours of the surrounding linoleum, which ranged from lighter to darker blue, with the yellowish and brownish tones of degraded areas. Due to the size of the loss the putty film could only be filled in step by step. The effort to insert the whole fill in one attempt was not successful, as this required a large amount of scattered heat that might stress the original material. Mechanically finishing the surface with a cranked chisel (20 mm wide) was also difficult because of the size of the fill. A smooth surface could only be realised by additional sanding using sandpaper of 180 and 400 grit.

Protective coating

Historical literature states that linoleum should be preserved by rubbing in a wafer-thin layer of polish made of wax and turpentine oil with a brush and a soft cloth. This not only protects the linoleum against mechanical wear but also preserves its neat appearance. In the case of the table only minimal residue of a waxy coating has been found (figure 43). After completion of the treatment the linoleum surface should be provided with a protective coating to protect the porous linoleum covering mass against moisture penetration through hairline cracks in the linoleum (figure 44).

The aesthetic aspects of the coating should also be considered. The coating should support the colour transition between the left and right linoleum halves of the tabletop. Moreover, linoleum surfaces usually show a certain gloss during their useful life, depending on the taste of its owner, the thickness of the coating layer, and the subsequent processing. The microcrystalline wax Cosmoloid H80 dissolved in Shellsol T has been successfully applied in recent conservation practice; it was used here in a 10% concentration. The application was carried out in an even thin layer with a fine cotton cloth, followed by rubbing without pressure with a dry cotton cloth. It should be noted that the coating produced little noticeable change in the degree of gloss. Nevertheless, the coating had the positive effect of optically harmonising the entire surface and its colour changes (figures 45, 46).

Condition after the restoration

The neutral fill resulted in the desired harmonisation of the linoleum surface and produced an
overall impression of integrity (figure 47). The viewer’s eye is no longer distracted from the bright, contrasting colours of the jute fabric, and one can experience the tabletop with its linoleum as a whole. The additions remain identifiable as such and are also clearly visible under UV light.

Example for a material-imitating filling technique
The second example presents the results of Nicole Nitschmann, also student at the Cologne Institute of Conservation Sciences. Here, a material-imitating technique for granite linoleum was carried out on a test sheet in a seminar about putties (figures 48, 49). This example was a first attempt. Nitschmann utilised the Beva 371 film as a top layer of laminate on a ground layer consisting of Degalan PQ 611 and cork powder.

The material-imitating granite linoleum laminate consisted of three different Beva 371-pigment blends: one for the background colour and two for the lighter and darker speckles (table 2). Using a grater, coarse speckles were produced. Scrap and cork powder were also included in the Beva 371 masses.

A film with the background colour was placed on a heating plate at ca. 90 °C, separated by a siliconised Hostaphan film. The speckles were then sprinkled into the softened film. Structures and texture could be modified with a wooden stick or a similar tool. Subsequently, the film had to be pressed again with a PMMA sheet. After inserting and welding the Beva 371 laminate into the loss its colour was deepened by applying Shellsol T. The gloss could be reduced by sanding or with a chisel. At a typical viewing distance the filling is hardly noticeable. At a closer distance the putty is apparent as such. This technique certainly leaves room for improvement, but the result can be assessed as good.

Benefits and challenges
Finally, the advantages and disadvantages of solvent-free Beva 371 as filling should be compared. Beva 371 shows a relatively good chemical stability during ageing and does not lose its flexibility, tensile, and bond strength. However, it does show a tendency to yellow. The material is reversible because of its low melting point of 65 °C and its

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Empirically determined recipes of a material-imitating fill.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material-imitating fill for brown-coloured granite linoleum</strong></td>
<td></td>
</tr>
<tr>
<td>basic tone</td>
<td>1.5 g solvent-free Beva</td>
</tr>
<tr>
<td>The material-imitating granite</td>
<td>0.1 g burnt umbra, light reddish, cyprian</td>
</tr>
<tr>
<td></td>
<td>0.1 g French ochre Havane orange</td>
</tr>
<tr>
<td></td>
<td>0.1 g terra di Siena nature</td>
</tr>
<tr>
<td>bright speckles</td>
<td>1.5 g solvent-free Beva</td>
</tr>
<tr>
<td>Beva-pigment mixture:</td>
<td>0.7 g linoleum powder (nature)</td>
</tr>
<tr>
<td></td>
<td>0.3 g cork powder fine (Ø 0.2-0.5 mm)</td>
</tr>
<tr>
<td></td>
<td>0.1 g French ochre light yellow</td>
</tr>
<tr>
<td>dark speckles</td>
<td>1.5 g solvent-free Beva</td>
</tr>
<tr>
<td>Beva-pigment mixture:</td>
<td>0.7 g linoleum powder (nature)</td>
</tr>
<tr>
<td></td>
<td>0.3 g cork powder fine (Ø 0.2-0.5 mm)</td>
</tr>
<tr>
<td></td>
<td>0.1 g burnt umbra black brown</td>
</tr>
<tr>
<td></td>
<td>0.1 g burnt umbra light reddish</td>
</tr>
</tbody>
</table>

grinding pigment mixtures with mortar and pestle mixing components in melting pot (ca. 100-120 °C) with a glass rod or a spatula rasping hardened Beva with a grater
non-polar properties, which allow removal of the film by heat and removal of residues with petroleum spirit. However, its polarity and solubility tend to shift to more polar agents during ageing. It has good adhesion to many materials and does not show any migration into absorbent materials. It is also very advantageous that it does not require drying time and no colour changes arise after application. The use of heat, non-polar solvents, and various tools allow for good processing and workability. Beva 371 can be mixed well with seemingly all fillers and can be retouched. However, its wettability and ability to be coated strongly depend on the binder-filler ratio and the character of the fillers.

The material allows for great freedom in modifications to achieve compelling visual results. The high flexibility can be used to replicate the optical and structural properties of the original materials. For example, imitations of craquelure or bark-like skin can be moulded with the aid of silicone mats.

Looking at the disadvantages, one has to stress that it takes some training to discover and master the material and its properties. Above all, colour adjustments can take a long time due to the slow mixing process of the highly viscous material and the aggregates. Furthermore, the filling material is technically difficult to implement in the case of very large losses. In these cases the levelling of the surface can take a lot of time, or one has to put a lot of effort into preparing technical aids.

The yellowing of Beva 371, mainly due to light ageing, seems to be a further problem. Beva 371 was included in the Canadian Conservation Institute (CCI) testing program and its yellowing was studied. It was found that visible discoloration (degree of yellowing = 0.10) was perceived at about 6 months of light ageing (700-800 lux, 1905W/lm) and at about 10 years of dark ageing. Extrapolation of the curves suggests that strong discoloration (degree of yellowing = 0.25) might occur within 80 to 120 years. These results are for a 0.1 mm thick film.

Nevertheless, the application of the material must also be considered with regard to the designated use of the furniture. This case study presents an object that is stored under museum conditions, which mostly excludes the causes for strong yellowing. Furthermore, the filling colour was adjusted to a slightly brighter tone to allow for future interventions like a glazed retouching when the colour may change.
There are efforts to improve the material formula of Beva 371 by replacing its critical tackifier with a more photo-chemically stable one. Despite this, it would be desirable to enlarge the potential selection of binders for linoleum fillings. Other thermoplastic deformable materials also show potential. Acrylates and PVAc have already been tested in this case study, and further experiences can be gathered.

Acknowledgements
The author would like to thank the Technoseum – Landesmuseum für Technik und Arbeit in Mannheim, especially Inge Osen for the project; the Kalker Werkstätten in Cologne, especially Heiko Ellermann for the discussions and the providing of naturally aged linoleum; Christian Imhoff for his particular support; the TH Köln – Cologne Institute of Conservation Sciences, especially Andreas Krupa, and Prof. Dr. Friederike Waentig for the discussions and their support.

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Notes
1 Hausen 1957, p. 51.
2 Krätz 1985, pp. 13, 15.
3 Ziegler 2000, p. 41.
4 Bodenbender 1931, pp. 455, 459.
5 Especially for light tones of a linoleum covering mass, typical for granite and also inlaid linoleum (Bodenbender 1931, p. 47).
6 Fritz 1924, p. 7.
7 Ellerman 2000, p. 64. Ellerman 1999 p. 92.
8 Despite the elastic properties heavy objects might leave imprints in the linoleum and cause irreversible damage. In such cases (for flooring), it was recommended to use appropriate furniture accessories made of glass, rubber and the like (Bodenbender 1931, pp. 408-409).
9 Hellmann 2000, pp. 48-49.

...
31 Bodenbender 1931, p. 416.
32 Bodenbender 1931, pp. 22, 416.
33 Bodenbender 1931, p. 416.
34 Platz 1933, p. 22.
35 Bodenbender 1931, p. 416.
36 Bodenbender 1931, pp. 22, 93.
37 Paste of rye flour for fixing linoleum to furniture. A recipe is not known, but a recipe for 25 m2 flooring was found in historical literature: mixture of 6-7 lbs rye flour and 1 lbs Venetian turpentine, and, if required, a few drops of carboxylic acid (to prevent mould formation) and a little water (Bodenbender 1931, p. 395).
38 Bodenbender 1931, p. 417.
40 Ellerman 1999, pp. 93-94. Kühn 2004, p. 89. The linoleum powder was obtained with the kind support of Mr. Marco Dowidat-Eskes (R&D Project Manager - Linoleum/Design at DLW Flooring GmbH) via the manufacturer DLW Flooring GmbH.
41 But the polish should be only occasionally applied on linoleum (Bodenbender 1931, p. 428).

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• Kathleen Kühn, ‘Die Inlaidlinoleumböden von Albin Müller im Sanatorium
• Dr. Barner, Braunlage, Konzeptentwicklung zur Konservierung’, unpublished diploma thesis FH Hildesheim, 2004
• Gustav Adolf Platz, Wohnräume der Gegenwart, 1933
• Sabine Weißler, Design in Deutschland 1933 – 45.
• Ästhetik und Organisation des Deutschen Werkbundes im >Dritten Reich<, 1990

Photo credits
• 1, 18-49: Julia Kun
• 6, 11-17: Bodenbinder 1931, table 2, pp. 390, 418-419
• 8-10: Julia Kun, Musterkatalog Möbel- und Wandlinoleum der Deutsche Linoleum-Werke A.-G., Linoleum-Großhandlung H. Mitter, Leipzig C1, Neumarkt 9, n.d. (due to the DLW logo: after 1938)

Suppliers
• Beva 371 heat-sealing adhesive – Gustav Berger’s Original Formula, 40% solution; Cork powder (fine, Ø 0.2-0.5 mm); Cosmoloid H80; Pigments (chromium oxide hydrate green, Cassel brown, bone black, titanium white, Indian yellow); Shellsol T; Watercolours: Kremer Pigmente
• Hostaphan® NT 36: Deffner & Johann
• Linoleum powder (‘Scrapmehl’); previously
• Armstrong DLW GmbH, Delmenhorst, Germany (now DLW flooring GmbH)
Birch + paint = bamboo

Lois Warnow

Between 1763 and 1767, two young noblemen set off on several journeys to see antique buildings in Italy, and to see France, the Netherlands, southern Germany, and especially England, the most modern and economically developed country of Europe at that time. It was Leopold III Friedrich Franz, known as ‘Prince Franz’, from Anhalt-Dessau, one of the German eighteenth-century principalities, and his architect and friend Wilhelm von Erdmannsdorf. Shortly after their return to Anhalt-Dessau these two chairs (figures 1-3) were built for a room in the Prince’s palace Oranienbaum. They are a pair of bamboo imitation (so-called faux bamboo) armchairs dating from 1767, which are part of a group of twelve chairs from the South-Chinese Room in the palace of Oranienbaum. Six examples of the group are lost and the remaining four are deposited. From 2014 to 2016 the two chairs have been at the University for Applied Science in Potsdam for conservation and restoration because they had considerable losses and were nearly falling apart.

Prince Leopold III Friedrich Franz and Friedrich Wilhelm von Erdmannsdorf

To put bamboo imitation and these chairs into context we have to step back and take a closer look into the history of Anhalt-Dessau.
Prince Franz of Anhalt-Dessau (1740–1817) succeeded to the throne in 1758 at the age of 18. He lost both parents in 1751 and was raised by his uncle Prince Dietrich, a representative of the Enlightenment. He supported the young man’s interest in science, nature, arts as well as the development of his social-political consciousness. During his reign Prince Franz undertook numerous reforms in the areas of education, health care, social services, roads, agriculture, forestry, and industry in his principality. He made Anhalt-Dessau one of the most modern and most prosperous of the small German states. Shortly after his nomination as the new prince he befriended Friedrich Wilhelm von Erdmannsdorf (1736–1800), a student and later architect. The Prince and von Erdmannsdorf were young and curious. They felt the urge to explore foreign countries and they were immensely impressed by what they saw. In England it was the ‘Chinese’ style in particular that made an impact on them. It is not proven - but very likely - that the two young men met the architect Robert Adam, the already famous cabinetmaker Thomas Chippendale as well as William Chambers. Chambers had travelled through China, and in 1757 he had published a book with drafts and patterns of Chinese architecture and interior designs (figures 4, 5). They definitely visited Chambers’ Kew Gardens and saw the already famous pagoda built in 1762. Indeed, as soon as Prince Franz and Von Erdmannsdorf returned to Anhalt-Dessau, they immediately started to form their newly acquired impressions into building and design projects. They created a very distinctive Chinese style while re-decorating several rooms in Oranienbaum Palace. They gradually transformed the former Baroque park into an Anglo-Chinese garden. By 1769, they started to build Wörlitz Palace (1769-1773), the very first neoclassical building in today’s Germany which initiated a wave of neoclassical taste in the German realms.

**Description, construction and coating system**

The faux-bamboo chairs had been part of the first wave of the re-decoration of Oranienbaum palace. Ordered by the Prince himself they were made for the so-called South-Chinese Room (R. 216). Indeed, they are regarded as one of the first examples of bamboo imitation in Europe. Although several other pieces of furniture and interior decorations had been made exactly after the drawings in William Chambers’ book Designs, the faux-
Bamboo chairs do not appear in the book but they obviously follow an English design. These ‘bamboo’ armchairs with latticework sides and backs are not made of real bamboo wood but of turned birch elements that form a frame construction. The extended rear legs are joined with two rails and form the back frame which is filled with latticework - turned sticks form upright and horizontal rectangular fields. The same latticework fills the frames of the armrests. The seat has a trapezoidal shape and is also constructed as a frame connecting the legs with rails. The inner rebate of the seat rails housed a drop-in seat, which is now lost. The brackets between legs and seat rails are in the shape of an arch segment jointed with small elements to the legs and seat frame. They do not add to the stabilisation of the construction but only have an aesthetic function.

How is it that even today we clearly recognise the intention of the designer and maker to imitate an exotic material? Two main features suffice to make the imitation believable: firstly, there are regular notches in the turned birch lattice segments, which imitate the characteristic bamboo nodes. Secondly, the chairs were painted all over to match the visual properties of bamboo, although, of course, the original appearance was different to what we see now due to over-painting and ageing.
In the course of the conservation we detected three coatings (figure 6). The first and probably original one consists of a yellow-brown undercoat (lead white, chalk, iron oxide red, ochre and some black pigments in an oil binder), a yellowish white base coat (like the undercoat, but less pigmented) and a resin top coat made from sandarac, mastic and colophony or turpentine. The second layer was done in the same manner as the first, but without the undercoat. It was added in only a few areas where there were missing parts in the coating. What you can see today is the layer of the third treatment, presumably dating from the early twentieth century. It was of a lighter brown but has darkened and attracted a lot of dirt.

So how did the chairs look like in the beginning? There is one area where you can still see the first coating because it has never been painted over, presumably because it is located at the bottom of a rail and they forgot to paint it. It appears like an ochre brown tone, similar to what we think bamboo should look like. However, considering the ageing of a resin-based coating (especially sandarac) and looking at the parts of the chairs where the present coating is lost so that the first one is visible, one has to admit that the colour was most likely more of a yellowish white than a yellowish brown (figures 7, 8).

The chairs’ conservation concept included the complete reconstruction of the lost elements and an attempt to remove the present coating, revealing the original. But due to the deep cracks in the surface it was impossible to remove the present coating without damaging the layers underneath. After having reconstructed the lost parts, we then tried to work out a sample for a new coating system based on the findings (figure 9).

Now we have an idea of what the chairs probably looked like in their original state. But what about the construction? While a coating of three layers indicates some effort in the surface finishing, a close look at the construction tells a different story. When we take a closer look at the construction and the material of choice it becomes clear that the local cabinetmakers who built the chairs did not focus on the importance of a stable construction, as they put every effort into the aspect of representation. They used birch, a wood species that moves considerably in fluctuating climate conditions. The legs had twisted a lot and the former parallel elements do not line up any more. Also, the main joint areas of the seat frame are far too small, there is almost no material that takes the tenons. Therefore, without stretchers between the legs the joints cannot take force and consequently must break. Of course, there are chairs without stretchers but usually they have wider rails and therefore more space for mortise-and-tenon joints that resist force. When dismantling the chairs it was revealed that there were joints with no glue at all and also dowel joints where the length of the dowel filled only one third of the dowel hole. Also, there are elements that differ in their length so that some of the joints were never formfitting and never could have been. Some of the gaps were filled with remains of all coating layers – showing that there was a gap from the beginning (figures 10, 11).

One can conclude that their ostensibly Chinese design and appearance complement the architectural setting they were intended for, but that the execution falls short when it comes to bamboo imitation. The attempt to combine traditional cabinet-making techniques and bamboo resembling rounded chair parts shaped from local material and a English-Chinese design did not prove to be a successful marriage in this case.

In 2014 we had to deal with the conservation and restoration of dirty looking repainted fragments of chairs that were falling apart due to a choice of material and craftsmanship that does not match the high-end luxurious appearance of the furniture.
(figure 12). So, how come the chairs, which represent one of the first of their kind, are built in such a poor way? What about other bamboo imitation chairs of this time?

Faux-bamboo chairs of the eighteenth century
The chairs for Oranienbaum Palace were by no means the only bamboo imitations during the late eighteenth century. The desire and fascination for Chinese furniture and accessories spread from England, initiated by Chippendale and Chambers.

But bamboo imitation in Europe did not appear before Chambers published his book on Chinese architecture and interior design in 1757. There are examples of bamboo imitation chairs mostly from England but also from Denmark and France. They are all made of painted hardwood. Some of them even have painted nodes instead of having them turned. Others show painted dots, even if you cannot find those when you look at real bamboo. The imitation of bamboo is done in many different ways but there are several chairs that also

Figure 13 Chair by Georges Jacob, France, 1780, Musée des Arts Décoratifs, Paris.

Figure 14 England, 1786-1794, David Garrick Chair, Victoria and Albert Museum, London.

Figure 15 Denmark, fl 1810, Brede, Dr. Henriette Graf.

Figure 16 England, fl 1815, corridor Royal Pavilion Brighton, Royal Collection Trust, Her Majesty Queen Elizabeth II 2016.
follow the same design idea with lattice work backs and framed lattice work arm rails. A lot of them are based on the designs of Chippendale or Chambers (figures 13-16).

The most similar ones to the chairs in Oranienbaum are five chairs in the storage of Sanssouci Palace in Potsdam (figure 17). They are side chairs without arm rests and with a concave seat frame. But apart from that they are a good match. Again they are made from turned bars with incised nodes. As with the Oranienbaum chairs the top rail is doweled into the back upright; the design as well as the construction of the corner brackets are the same. But the ones from Potsdam are built in a slightly more accurate and thoughtful way, and the construction is improved in a few aspects. The latticed back, for example, consists of more rods/pieces, which add to its stability. Also, H-shaped stretchers are adjoined between the legs. In the main joints also there are improvements. The seat rails of the Potsdam chairs have a wider diameter in order to increase the stability of the mortise-and-tenon joints.

The improved construction goes for all of the other bamboo imitation chairs. None of them are built in exactly the same manner as the Oranienbaum ones. They have either stretchers that support the construction, or wider rails with more space for the joints. But as all the other chairs have been produced up to fifty years later, one could easily say that there must have been an improvement. It is also known that there was not a lot of nobility residing in the area, so even if there was a lot of work to do, not many highly qualified cabinetmakers existed in Dessau-Wörlitz. It is very likely that after the first big redecorating and building process the most decent cabinetmakers stayed (e.g. cabinetmaker Irmer, who should be responsible for most of the furniture at Wörlitz Palace). Maybe the construction is poor because there were no models and the makers had never seen real bamboo or other bamboo imitation chairs, and therefore they did not know how to do it. But the main reason for the poor construction and material of

Figure 17  England, 1786-1794, David Garrick Chair, Victoria and Albert Museum, London.

Figure 18  William Hogarth, Marriage à-la-Mode 2, The Tête à Tête, f81743, oil on canvas.
The seventeenth century loved the Chinese style because China represented a ‘great, unified, centrally governed state, considerably larger than any kingdom in Europe, provided with an unbroken cultural tradition for millennia, a kingdom without aristocracy and without a church comparable to the Curia, with a comprehensive philosophy and morality and such a variety of teachings that almost every impulse could find its model.’

The eighteenth century - and Prince Franz in particular - loved the Chinese style because of its intriguing ideas very different from the absolutistic monarchic system of the western Baroque period. Prince Franz belonged to those within the upper class that were bored by all the glamour, excess and abundance. They were craving something new (figure 18).

Prince Franz was the friend and student of Rousseau, Winkelmann, Sterne, Chambers and Goethe. So he, and also Von Erdmannsdorf, formed part of the Enlightenment - willing to change society in a way that included more social justice and a closer relationship to nature. As Rousseau said: 'Back to nature!', or: 'No man has any natural authority over his fellow men.' and 'Force does not constitute right... obedience is due only to legitimate powers.' These views had a deep impact on the style of art, architecture and furniture making. Von Erdmannsdorf and the Prince were convinced that ‘the noble simple shapes and decorations of antiquity, the plain, simple furnishings with its expressive outlines educate the mind to simplicity, clarity and morality.’

What was important was simplicity and naturalness. And here we go: bamboo is a perfect symbol for simplicity and naturalness! The upper class in China at the time, which was firmly rooted in Buddhism and Taoism, liked bamboo as a symbol for humility and nature. It was said that the upright growing of bamboo stands for a strong character and that bamboo is strong to resist attacks but is still flexible. The empty inside stands for modesty but also means space for more knowledge.

One could ask: why not use proper bamboo then? According to Chambers, chairs made from bamboo belonged to the interior of a Chinese palace: ‘The movables of the saloon consist of
chairs, stools, and tables; made sometimes of rosewood, ebony, or lacquered work, and sometimes of bamboo only, which is cheap, and, nevertheless very neat.¹⁹ But as a matter of fact, bamboo was a material that was mostly used by the poor in China. It was not as long-lasting as hardwood. People threw bamboo furniture away as soon as it was damaged, as they rather built new ones. (That is why almost none of the bamboo furniture of the late Ming and early Qing dynasty has survived.) Using hardwood and not bamboo makes you a part of the educated upper class but at the same time shows that you have a wise mind and appreciate the simplicity of the poor. There are some examples of bamboo imitation in China dating circa 1780 (figures 19-20a).¹⁰

Conclusion

The bamboo imitation chairs from Oranienbaum Palace can be interpreted as examples for a ‘modern’ way of thinking. They are one of the first attempts to come clean with the highly religious and long-established structures and therefore they start something new and different. The idea of these chairs is not Baroque but being modern and simple. Therefore, it is not important to show the knowledge of high-end furniture construction. But still, they are Baroque in their function as a ‘safe haven’. Like in the Baroque period the enlightened upper class created themselves ‘safe havens’, which means places to escape from reality. It was a time when their reign and power given to them by ‘god’s will’ was not regarded as natural and self-evident any more. The ‘Chinese’, the ‘exotic’, was a way to escape their sometimes frightening reality. It stands for ‘wanderlust’, the urge to explore, the wish for foreign, exciting things – what one can find already in renaissance with the upcoming Kunstkabinette, filled with curiosities from all over the world.

Furthermore, the chairs’ function of representation is the very same as during the Baroque era. They were not made for comfortable sitting or for endurance. Fully in tradition with high-end Baroque and Rococo, their most important function is pure representation and decoration. The failing construction was obviously of no importance. These chairs clearly show that in this case form was more important than function. They were props, representing the Prince’s knowledge of and for all things foreign and modern – suitable ornaments in his garden-kingdom with pagodas, tea houses and even a volcano (figures 21-22).
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Notes
2 Compare figure 5, drawings number 2 and 6, with wallpaper on figure 3.
3 Identified using GC-MS (A. Fuhrmann, Hochschule für Bildende Künste, Dresden), FT-IR (C. Fuchs, Fachhochschule Potsdam) and RFA (J. Bartoll, Stiftung Preußische Schlösser und Gärten).
5 Büttner 2007, 34.

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• Figures 1-2, 6, 8-12: Louise Warnow.
• Figure 3: Messbild der Staatlichen Bildstelle Berlin 1926/27, Süd-Chinesischer Raum: Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum; Negativnummer 30 c 24 / C 37 63.25.
• Figures 4-5: Chambers, 1757, plates XIII and XX.
• Figure 7: Daniel Obenaus,
• Figure 14: Victoria and Albert Museum, London.
• Figure 15: Dr. Henriette Graf, 2016.
• Figure 16: Royal Collection Trust ©Her Majesty Queen Elizabeth II 2016.
• Figure 17: Stiftung Preußische Schlösser und Gärten.
• Figure 19-20a: Shixiang, 1990, pp. 53, 139.
• Figure 21-22: Kulturstiftung Dessau Wörlitz (KsDW), Heinz Fraßdorf.
Decorated paper on the inside of an eighteenth-century writing cabinet

Tirza Mol

Decorated paper is the collective name used for paper that is coloured or patterned by hand or with the aid of a press. It was used principally on book bindings and endpapers and on the back of playing cards, but is also found as a lining in chests and cupboards.

After Johannes Gutenberg developed his system of moveable metal letters, in the middle of the fifteenth century, the number of printed books increased rapidly. In the sixteenth century decorated paper and cardboard were often used as a cheap alternative for parchment or leather for the boards of books. From the seventeenth century, decorated paper was also applied to the inside of furniture. The technique became quite popular in the eighteenth century when a variety of new manufacturing processes made the papers more readily available.

The use of decorated paper as an imitation of luxurious materials was in full accord with the Baroque period. Illusion and trompe-l’oeil effects are examples of some of the theatrical aspects characterising the art produced in this period.

An example of the application of decorated paper in furniture can be found in an eighteenth-century writing cabinet (figure 1). The object is of South German or Austrian origin, and can be recognised as being from the late Baroque period. The inside of the upper case is partly furnished with decorated paper (figure 2).

Inside the writing cabinet, three different kinds of paper have been applied. A brocade paper had been applied when the object was first assembled. It lines the central part of the object and the inside of the drawer above the central door. At some later time, this brocade paper was partly covered with a chintz paper (figure 3). The outer drawers are lined with this chintz paper only (figure 4). The drawers in the internal drawer case are lined with a marbled paper (figure 5). The papers and their production are briefly discussed below.

**Brocade paper**

Brocade paper is used as an imitation of gilt leather or brocade (figure 6). Its production started in the late seventeenth century in Southern Germany. As
with gilt leather the patterns depict mostly flowers, foliage and animal motifs.\textsuperscript{7} The production of this embossed paper requires the use of a press. The paper is painted and placed on a piece of felt. Next, the sheet is covered with a layer of egg white. The paper is dampened and covered with metal leaf (usually brass or tin). An engraved metal plate is heated and laid on top of it. With a rolling press, pressure is applied so that the thin foils attach to the raised parts of the paper. The egg white applied in the previous phase serves as an adhesive. The remaining metal is brushed away and the paper is now decorated in so-called silver or gold.\textsuperscript{8} Brocade paper lost its popularity towards the end of eighteenth century. In the Rococo period chintz paper came into favour.\textsuperscript{9}

\textbf{Chintz paper}

This decorative paper is suggestive of chintz textiles imported from India (figure 7). Original Indian chintz was very much sought-after. It was a printed cotton fabric, typically decorated with floral and foliate patterns, with complicated details. From the seventeenth century, European colonial powers were very active in the trade in textiles from Asia. Initially they traded the textile, but gradually started to produce their own. However, during the eighteenth century, economic circumstances forced many European cotton printers to start printing on paper, which was a cheaper material. The same technique and designs were used, hence the name chintz paper.\textsuperscript{10} The production procedure is similar to that of textile printing; the high parts of a wooden block with a specific carved pattern are covered with paint and pressed on the paper. To make sure the prints line up correctly, repeat pins are fitted in the corners of the blocks.\textsuperscript{11}

\textbf{Marbled paper}

Several countries, such as China, Japan and countries from the Middle East, claim to be the origina-
tors of marbled paper. The accepted theory is that European craftsmen learned the technique from the Turks; marbled paper is sometimes referred to as Turkish paper. The variety of marbled papers is almost unlimited. There are stone marbles, combed marbles, feathered marbles, fantasy marbles, and so on. The marble paper in the writing cabinet is a combed marble (figure 8). This was the most commonly used variation in the seventeenth century and was mainly realised in the colours red, yellow and blue.

Hand-marbled papers are made by floating paints on a liquid surface. The water-based paint layers stay afloat on the surface of water that has been made more viscous by seaweed extracts or gums. Ox-gall soap was traditionally added to improve the rheological quality of the paint. A rake or comb is used to mingle the paint. After the desired pattern is achieved, a sheet of paper, previously treated with alum, is laid gently onto the surface of the bath. When the paper is lifted off, the paint has stuck to it. A new paint layer has to be created for each new sheet, which is why no two hand-made marble patterns are ever the same. The nineteenth century was marked by industrialisation. Hand bookbinding was diminishing and the production of hand-decorated paper declined sharply. Only in the 1890s, with the ascent of the Arts and Crafts movement, it once more became popular.

The past few decades have seen a new surge of interest in the technique. A very positive development, as most of the old paper that we encounter in cabinets and chests is in poor condition. The paper in this writing cabinet, for example, is locally discoloured, it is buckling, cracking and loosening. Lacunas show the bare wooden support. The paper is stained and has accumulated grime on the surface (figures 9, 10, 11). The woodwork of the object has been restored (figure 12). The paper, however, has not yet been treated. Hopefully it will be treated in the near future.

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Figure 9: Details of two pieces of chintz paper. The chintz paper in the central part (above) has lost colour compared with the paper in the drawers (below). The paper in the central part of the cabinet has probably been more often exposed to light.

Figure 10: The brocade paper is loosening, cracking and has suffered material loss. It has accumulated surface grime.

Figure 11: The marbled paper is stained and has accumulated surface grime. It is loosening at the edges and some lacunas are visible.
Notes
1 A. Meincke, C. White and K. Nichols, 'Decorative and functional use of paper on furni-
3 Meincke, White and Nichols 2003, p. 2.
5 The Baroque was introduced relatively late in Germany. The thirty-year war (1618-1648) may have contributed to this late adaptation even in court circles.
6 Meincke, White and Nichols 2003, p. 3.
8 Heijbroek and Greven 1994, p. 63.
9 Heijbroek and Greven 1994, pp. 63-64.
13 Meincke, White and Nichols 2003, p. 3
14 Meincke, White and Nichols 2003, p. 2.
15 Hesse und Kraus 2007, p. 25.

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• All photos were taken by the author.
Curiously engraven: the new art of japanning and an exploration of depictions of Asia in eighteenth-century London and Boston

Tara Cederholm

Introduction
This paper explores the possible design sources for the japanner in late seventeenth- and early eighteenth-century London and colonial Boston. It is an outgrowth of a larger research project focused on the japanned furniture produced in Boston during this period. Beginning in 2012, Christine Thomson and I embarked on a project to revisit the japanned furniture from Boston, focusing primarily on the decorated surfaces. This topic has long been of interest to scholars of American decorative arts and while many articles have been written on the subject, a clear picture of the topic still seemed a bit elusive.

By taking a new approach to the subject we hoped to uncover some new information. Only fifty-four pieces of Boston japanned furniture survive today, so completing a detailed examination of each object was an achievable goal. Over the course of about nine months we examined in detail thirty-nine of the extant examples of Boston japanning. We took photographs of each of the motifs and using an image database we tagged each individual image with key words, making the images searchable. In total, our current database has close to 1000 images. Using this database we can now easily search for various motifs, such as ‘cranes’, and then make comparisons between the various hands at work. We used the few signed examples as a touchstone to compare with the many unsigned pieces. It was our belief that the hand of the decorator was as individual as a signature and that by using this method we would be able to separate the pieces into recognizable groups.

During the course of this project, we became interested in what sources were available to the japanner as inspiration for the japanned design motifs. This paper explores in-depth the traditional idea that the sources were printed materials such as travelogues, encyclopedias and how-to manuals. While interesting in themselves, none of these early published images have a direct relationship to the imagery found on Boston or London japanning. I will propose and explore a new theory that the imported porcelains and lacquer screens bear a much closer relationship to the imagined landscapes of japanning.

Figure 1 Japanese lacquer cabinet raised on a Dutch gilt stand, c. 1630-50, in the Long Gallery Ham House, Richmond-upon-Thames, National Trust, NT14084. First included in the 1679 inventory.
An English japanned example now in the Victoria and Albert Museum is remarkably similar (figure 2). This chest was made in London in about 1680 in imitation of a Japanese import. It is these imitators that will be the focus of this paper. To fully appreciate these pieces it will be helpful to understand the context in which they were created.

**Historical context**

By the early seventeenth century the elite class in Europe was fascinated by the novel imports coming from Asia. Porcelains, silks and lacquers were imported to Europe as early as the sixteenth century. For Europeans, all these objects were exotic, both because they were made of new and unfamiliar materials and because they came from distant and unknown places. Their decorative surfaces contained some of the first glimpses of Asia seen in the west.

Porcelains, which could not be produced in Europe at this time, were particularly cherished. They were often mounted in silver, silver gilt or gold and would have formed part of a royal or aristocratic ‘cabinet of curiosities’. One such example is a ‘kinrande’ cup that was produced in China during the Jiajing reign (1522-1566) and is inscribed on the mounts indicating its purchase in Turkey and subsequent mounting in Germany in 1583 (figure 3). At this time, Chinese porcelains could have made
their way to Europe overland through the Middle East, as the inscription on this piece indicates.

By the sixteenth century sea routes were another viable alternative for Chinese ceramics to have been brought to Europe. The Portuguese, with their great maritime fleet, had established trade with Asia by the middle of this century and were initially responsible for much of the influx of Asian goods. A Chinese ewer, now missing its handle, was commissioned specifically for the Portuguese market and dates to the early sixteenth century (figure 4). It is painted with the coat of arms of Portugal; however, the artist must not have understood the meaning of the image they were asked to emblazon on the surface, as they have applied it upside down. The form itself is inspired by a Middle Eastern metal work ewer, further evidence of the back and forth exchange between China, the Middle East and the West.6

Lacquer was also highly prized as another exotic substance that could not be made in Europe. Perhaps one of the most well-known examples of Japanese lacquer imported to Europe is the ‘Van Diemen’ box (figure 5). It is inscribed on the inside of the lid ‘Maria van Diemen’ for the wife of Anton van Diemen, the Governor-General of the Dutch East Indies from 1636 to 1645.

Early in the history of the Dutch East India Company the records indicate that large quantities of lacquer were imported. However, by the mid-seventeenth century that number had decreased significantly. The officers of the company were allowed a certain amount of cargo space for their own private trade and it seems probable that they were responsible for much of the lacquer that arrived in Europe. The large quantities of Japanese lacquer from the seventeenth century in old collections in Europe attest to the scale of the private trade in this ware. This box was likely part of such a private cargo, and either brought or sent back by Van Diemen as a gift for his wife.7

Chinese lacquer was also imported in large quantities. Particularly plentiful was a type of screen often known as a ‘Coromandel’ screen, based upon a misunderstanding that these screens were produced in India along the Coromandel coast (figure 6). Instead, they were created in various parts of southern China and simply traded through the ports of India. In seventeenth-century England these screens could also be referred to as ‘Bantam work’, as the English trading port at Bantam in Java served as one of the transshipping port for these goods. Frequently thought of as an export product these screens were first developed for domestic use in China. The iconography is purely Chinese and was
rarely altered for the Western taste. These screens were developed in China as a cheaper alternative to the more time-consuming and therefore more costly screens produced for the Imperial court. The Imperial examples would have been made by carving a lacquer substrate and then inlaying it with either mother-of-pearl or various other colored lacquers and then polishing the surface to an even level exposing the design. Here the lacquer artist has simply carved away areas to create the decoration and then quickly painted those recessed areas with a colored lacquer paint. This is a much more efficient process as it eliminates the time to cut the mother-of-pearl or inlay the other lacquers. This lower production cost, and a relaxation of the Imperial rules surrounding craft practices at the end of the seventeenth century probably combined to make these screens very popular with the Chinese merchant and official class. These screens quickly became popular in Europe and were imported in large quantities. While the shipping records of the English and Dutch East India Companies do not necessarily specify the types of screens imported, screens are mentioned often. In 1702 three ships from the English East India fleet return to London with their cargo which contained '70 chests of screens' along with other Asian goods. The colorful patterns and exotic scenes must have delighted Europeans. The charming image in figure 7 (a detail from the screen illustrated in figure 6) depicts ‘the hundred boys’, a classic Chinese subject expressing the wish for many descendants. The boys in their patterned silk robes and top knot hairdos would have been exotic indeed. Screens were not employed in Europe as they had been in China; that is as room dividers. Instead they were used a raw material and transformed into purely European objects. A looking glass, now at the Victoria and Albert Museum, is a good example of how these screens were reworked into familiar European forms (figure 8). Here a joiner has dismantled a screen and then sliced each panel in half lengthwise creating a veneer of lacquer. This technique allowed for the craftsman to use both sides of the screen and prevented the waste any of the precious material. The joiner has then applied the lacquer, much like a hardwood veneer, to an English wood substrate, creating a form familiar to his customers, but clad in an exotic new material. Coromandel screens were often incorporated as wall paneling in rooms, creating a fashionable ‘china closet’. Many inventories from the late sev-
Curiously engraven: the new art of japanning and an exploration of depictions of Asia in eighteenth-century London and Boston

teenth century across Europe mention these ‘china’ or ‘japan closets’ but very few of them have survived, probably because the craze was short-lived and the owners were continuously upgrading their interiors to keep up with the ever-changing court fashions. A room created in the 1690s for the Stadtholder’s court in Leeuwarden, the Netherlands, now installed in the Rijksmuseum, is one of the few survivals (figure 9).10 A similar ‘japan closet’ was installed at Chatsworth by Gerrit Jensen in 1692 and dismantled only eight years later in 1700.11

Leaving behind the imported Asian goods, I will now take a closer look at japanning. For the remainder of this paper I will focus only on the japanning produced in London and colonial Boston. The images of porcelains and lacquers will return at the end of this paper as I explore the possible design sources.

Japanning in London and colonial Boston
This English cabinet on stand at Temple Newsam, dating to the late seventeenth century, is a good representation of the first flourishing of japanning in England (figure 10). Japanning becomes popular in England after the ascension of Charles II to the throne in 1660. It has often been suggested that this vogue for japanning may have come from Charles’s bride, Catherine of Braganza, whose dowry included a number of Asian lacquer pieces as well as the port of Bombay, giving England a base for trade with Asia. However, an alternative theory is that the period of the royal exile, which Charles spent partially in the Netherlands, was a time that allowed Charles himself to be exposed to and develop a taste for the fashion for Asian goods and their imitations.12 What is most likely is that it was a combination of all these factors which brought the taste for the ‘Asian exotic’ to London.

It is not hard to see how the more elaborate, aristocratic form of the Temple Newsam chest was transformed to the cabinet on stand or high chest of drawers. This simpler form was more likely to have been found in a wealthy merchant’s home and was common in both London and Boston. Figure 11 is a London example. Unfortunately it is missing the turned legs and is raised now only on its short round feet. However, the japanning is in a remarkable state of preservation. An example produced in Boston in the 1710s is illustrated in figure 12. These two pieces are quite similar in both the overall form and the quality and type of japanned decoration. In

![Figure 11](image1.png)
**Figure 11** Japanned high chest of drawers, England, c. 1680-1720, Victoria and Albert Museum, W.2:12-1951.

![Figure 12](image2.png)
**Figure 12** Japanned high chest of drawers, Boston, c. 1720, private collection.

![Figure 13](image3.png)
**Figure 13** Detail from a japanned desk and bookcase, London, c. 1720, sold at Sotheby’s April 24, 2008, lot 18, current location unknown.
fact they are equally accomplished examples. The Boston work is not a poor imitation of that made in London.

So who were these London craftsmen who developed such skill and virtuosity with this new medium? At this time we don’t know much about them. However, we do know that they did not have their own livery company. It has always been assumed that they would have been members of the Painter-Stainers’ company since that craft seems to us today most closely related to japanning. However, it is equally plausible that they belonged to no livery company, but rather as a group aligned themselves with the company whose interests they most closely shared.

In 1701, the Joiner’s company filed a petition to Parliament to restrict the importation of Asian lacquer into England, claiming it was undercutting the work of the local cabinetmaker and japanner. The japanners likely allied themselves in this case with the joiners as they were a very powerful guild. They also would have had strong working relationships with joiners as they were decorating the pieces built by them, in many cases probably working directly for them rather than for the end customer. One thing we do know is that japanners were highly skilled and would have been trained in the specific techniques to create each of the decorative motifs. There were standard methods and conventions employed to successfully create the imagined landscapes which decorate the surface.

When compared side by side it is clear that the same techniques and motifs that were used in London can also be found on Boston japanned pieces. Figures 13 and 14 illustrate the same winged insect found on London and Boston work respectively. It is not only that the depicted insect appears to be quite similar, but also the way in which it is executed that is important. In each case, the japanner has created the motif by using oval shapes for the wings and then employing exactly the same series of thin brushstrokes to indicate the legs and antennae.

I have found numerous examples of the direct relationship between Boston and London work. This relationship has not been studied before, but it should not be a surprise. At the turn of the eighteenth century Boston was not a backwater, but rather the royal colonial outpost of one the most powerful nations in the world. At that time the journey from London to Boston could take as little as six weeks. There is no reason to assume that the work produced in Boston was in anyway inferior to the work created for the merchant class of London.
Figures 15 and 16 illustrate examples of the japanner using nearly the same composition. On both the London and Boston pieces the japanner has depicted a seated figure, attired in robes and a hat, leaning against a fence. While the small details of the work are not identical and the image has been flipped, the overall design is strikingly similar. In figures 17 and 18 each japanner has used the same techniques to produce nearly identical flower pods, perched atop long stems. Each of the flower pods are enhanced with similar black pen work composed of two horizon lines encircling the top and curved vertical lines below. These simple lines create the sense of volume in the flower pod.

The earliest Boston japanners appear, in newspaper advertisements and court records, in the early seventeenth century. Many of these Boston japaners, including the two that actually signed their work, William Randle and Robert Davis, have no known birth records in Boston. The quality of the work that they produced would suggest that they were London-trained craftsmen who immigrated to Boston fully capable of this new craft. In fact, research at the Guild Hall in London has revealed the apprenticeship records of both William Randle and Robert Davis.14

The early Boston japanners were in fact London japaners. In the absence of a signature or a label it is really only the wood used in the construction of the furniture itself that can confirm the place of origin. The high chest of drawers made in Boston and signed by Robert Davis is extremely skilled work (figure 21). This is not the work of someone self-trained or working outside of the style center. It is highly accomplished work with a direct relationship to that produced in London.

Design sources for the japanner

What exactly were japanners on both sides of the Atlantic looking at for inspiration? Innumerable articles on japanning cite the 1688 A treatise on japaning and varnishing, by John Stalker & George Parker, published in London, as a possible design source for japanners. Often quoted as a professional manual for craftsmen learning ‘japanning’ it is more likely a book for amateurs, particularly young ladies, to learn the skills required. It is only one of several such how-to-books written on the subject, although it certainly seems to be the most well-known. This book includes recipes for creating various colors of japanning, ‘gilding, burnishing and lacering’, as well as imitating tortoise shell. At the end, the authors have included more than a ‘hundred distinct patterns for Japan-work, in imitation of the Indians, for tables, stands, frames, cabinets, boxes, etc. Curiously Engraven on 24 large Copper-Plates.’15

It is these patterns that have long been assumed to be the source of inspiration for the japanner in both Europe and America. However, to date, none of the Boston or London pieces that I have examined...
reveal the influence of this book. While this book was certainly popular and contained detailed, and for the most part, accurate recipes for the creation of japanned surfaces, it simply does not seem to be a primary source of design inspiration.

Other potential imprint sources for the japanner include early books about Asia published in Europe. One such example is China Illustrata, an encyclopedia on China published in 1667 by Athanasius Kircher, a German Jesuit scholar. Kircher himself never travelled to China, but based at the Jesuit College in Rome he was ideally situated to compile the reports of the many Jesuit missionaries to China.

Some of the engravings in this volume are remarkable, such as one depicting the ‘Winged turtles of Henan’ (figure 22). In addition to the turtles, this image depicts palm, as well as other exotic trees. However, the houses shown in the back left appear more European than Chinese. Careful examination of all the engravings in this book have not led to any direct relationship with any known japanned work.

In 1655 Johan Nieuhof travelled with the Dutch East India Company on an Embassy to Beijing. The
Dutch made four such journeys to Beijing in an attempt to win trading rights with China and break the Portuguese monopoly. None of these Embassies were successful and the Dutch were prevented from trading, at least legally, directly with the Chinese. Nieuhof was requested to document the many towns and villages along the journey, describing them and making drawings. Seven years after returning to Holland, a Dutch version of his book, documenting his travels and the sights he had seen, was published in 1665. It was quickly followed by French, German, Latin and English versions. Some scholars have suggested this book as a likely source for the Boston japanner. And while it does include a number of exotic and fanciful illustrations of China, complete with pagodas, there is no direct correlation between the images here and those found on japanning in London or Boston (figure 23).

Certainly the popularity of these travel logs and encyclopedias attest to the great interest in China, and Asia, at the time. And it is this same interest that also accounts for the development of decorative arts in imitation of Chinese and Japanese objects. But in no other way are these images related to English japanning. It is really only when comparing the porcelains and lacquers exported from China that a more likely design source for the English japanner emerges. Comparing japanning details with ceramics a pattern of lifting of individual Chinese motifs and design elements becomes clear. Figure 24 is a detail from a Chinese teapot depicting a somewhat stylized lion. A related japanned image is shown in figure 25. In some cases the japanner has fairly accurately understood the imagery such as with the depiction of this mythical beast. In some other instances, the japanner did not fully understand the iconography he was imitating. The large figure in the middle of the Chinese jar is probably the Goddess of Longevity, who is often depicted with her two attendants with peacock feather fans (figure 26). These smaller figures on the japanned pieces have long been mistaken for children, but are more likely misinterpretations on the japanner’s part of images of attendants (figure 27). In Chinese depictions attendants are always shown as smaller in scale than the main character in the story.

While ceramics could certainly have been a source for the japanner, one must also consider the world of the seventeenth- and eighteenth-century crafts-
man and what sources were directly available to him. As I have already established, japanning was a newly developed craft without its own guild and the prestige that affords. True porcelains were still very expensive at this time. It seems highly unlikely that a japanner would have had firsthand knowledge of Chinese ceramics - or the opportunity to study them carefully.

A closer look at the relationship between Chinese coromandel screens and japanning yields some very compelling comparisons. In some cases entire decorative schemes may have been lifted from the coromandel screens by the japanner. In this example, the japanner has adopted the iconography of the ‘Hundred Antiques’ imagery which was found on many coromandel screens, often in the borders (figure 28). This subject can include precious objects, antiques and other decorative objects, such as these archaic bronzes vessels, a scholar’s rock and a low dish with narcissus seedlings. To Chinese audiences this imagery was clear; it depicts treasured objects and celebrated antiques symbolizing a reverence for tradition and the scholarly pursuit of collecting. In the japanner’s work he has depicted similar vessels arranged in a landscape and even included the peacock feather emerging from the censor (figure 29). Whether the japanner or his customer understood the subject matter is hard to say, but in their borrowing of Chinese imagery japanners made regular use of the ubiquitous Chinese ‘Hundred Antiques’ motifs.

It is possible to make many such comparisons between these Chinese screens and the work of the japanner, just as with the porcelains. However, when looking beyond the overall motifs and focusing on the small details of how the objects are depicted the influence becomes more compelling. Returning to the ‘hundred boys screen’ illustrated earlier and comparing the depiction of a cockerel with a japanned example this relationship can be seen quite easily (figures 30 and 31). It is true that the bird on the japanned piece bears a striking resemblance to the lacquer one in the overall stance, the way the wings are set and the large drooping tail feathers. But close examination of just the feet of the birds reveals a deeper connec-
Curiously engraven: the new art of japanning and an exploration of depictions of Asia in eighteenth-century London and Boston

In both cases the artists have depicted the feet by using a larger tear drop shape for the toes and then added a thin, curved line ending in a sharp point for the talon. The screens were carved, similar to the techniques used for carving wood blocks used in Chinese printing processes. The japanner has reinterpreted these carving techniques with brush and paint.

The maker of the lacquer screen and a Boston japanner may have each used the same techniques to create the illusion of the edge of land as it meets a body of water (figures 32 and 33). Looking closely at the two images one can see that the face of the land mass is depicted in each case as an oblong element containing several vertical lines and then one longer line that extends horizontally beneath the adjacent lines. Here on the screen the carver has left these lines in relief, carving away the space around them. The japanner has used black paint to apply these lines to a gilded ground.

A comparison of just one vignette of this same screen (figure 34) with details from a variety of japanned pieces provides several more examples of the direct relationship in these two art forms. The depiction of the pine tree on a japanned high chest (figure 35) mimics that of the screen. The japanner has employed upward curving lines extending from a central point, similar to the carved treatment on the screen, to indicate the needles of the tree. The small dots rendered under the bird and the foliage on a japanned high chest serve as a grounding technique (figure 36). Often the decorative designs placed on japanned pieces can appear to float in space. This technique of creating a ground surface under these elements is seen on almost all japanned pieces produced in London and Boston and likewise appears repeatedly in the Chinese screens.

A final example of the japanner’s shorthand method for depicting a willow tree further emphasizes this connection (figure 37). Here again the brush strokes, downward and slightly outward, are similar to the lacquer worker’s carving technique.

I believe that this series of images makes a convincing argument that Chinese coromandel screens were a probable design source for the japanner. It is not this visual evidence alone that is convincing,

Figure 33 Detail from a japanned tall case clock, the movement by John Doane, Scituate, the case Boston, c. 1740, private collection.

Figure 34 Detail from a coromandel screen depicting the ‘hundred boys’ theme shown in figure 7, China, Kangxi period 1662-1722, private collection.

Figure 35 Detail from a high chest of drawers also shown in figure 16, Boston, 1735-1760, Gift of Miss Ima Hogg, Museum of Fine Arts, Houston, Bayou Bend collection, B.69.348.

Figure 36 Detail from a high chest of drawers also shown in figure 18 and 20, Boston, 1700-1730, Gift of Bob and Jo Wagner, Milwaukee Art Museum, M1000.102.
This paper has presented a brief look at japanning, and its initial develop in Europe within the global context of the incredible trade in luxury goods from Asia. Focusing on the work produced in London and colonial Boston I have presented the theory that imported lacquer screens represent a new and not yet fully explored resource of exotic Asian imagery available to the late seventeenth-century craftsman. I hope to continue this research in the future.

Acknowledgements
I would like to thank Christine Thomson for her steadfast collaboration on this ongoing research project. In addition she has helped to formulate and test the many ideas presented in this paper. I would also like to thank KC Cederholm for his expert assistance editing many of the images included here.

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Notes
1 There are five signed examples of Boston japanning extant today. A high chest of drawers at the Adams National Historical Site in Quincy, Massachusetts signed by William Randle, a high chest of drawers in the Baltimore Museum of Art signed by William Randle and Robert Davis, a high chest of drawers in a private collection signed by Robert Davis, a tall case clock in the Rhode Island Historical Society signed by Robert Davis but also signed by two later nineteenth-century japanners and no longer retaining any original surface and a tall case clock in the Harvard University Art Museums labeled by Thomas Johnston but now stripped and lacking any japanned surface.
2 For a fuller discussion of our project and pieces we have attributed to the hand of the Boston japanner Robert Davis see T.H. Cederholm and C.P. Thomson, “’Tortoiseshell & Gold’: Robert Davis and the Art of Japanning in Eighteenth-Century Boston” in: Boston Furniture, 1700-1900, Edited by B. Jobe and G.W.R. Ward, 2017, pp. 48-75.
3 This paper is focused only on japanning produced in Boston and London and not expressions of the form from continental Europe including The Netherlands. Although I am grateful to Michiel de Vlam for sharing information about
two Dutch cabinets with japanned decoration drawn from an image in Johann Nieuhoff’s 1665 An Embassy of the East-India Company of the United Provinces, to the Grand Tatar Cham, emperor of China. See endnote 18 for citations about these pieces.

See the National Trust website for details on the chest on stand at Ham House http://www.nationaltrustcollections.org.uk/object/1140084.1 and the set of japanned back stools http://www.nationaltrustcollections.org.uk/object/1139867.6.

For further details on this mounted cup see the Victoria and Albert Museum website http://collections.vam.ac.uk/item/O109106/cup-unknown/


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A Dutch seventeenth-century European lacquer cabinet.  
Material-technical analysis to gain insight into the deteriorated surface

Elise Andersson,* Vincent Cattersel

Abstract
A cabinet of unknown provenance in the collection of the Cultural Heritage Agency of the Netherlands has drawn the attention of conservators and art historians due to its peculiar appearance: a ‘typical’ seventeenth-century Dutch cabinet-on-stand decorated with imitation lacquer depicting Asian-inspired motifs mixed with European features. The lacquer suffers from craquelure, alligatoring, discolouration, bloom and lacunas which impair the brightness of the colours and the lacquer’s smoothness, transparency and gloss, reducing the readability of the decoration. The scarce knowledge about the cabinet and its current aesthetical appearance required a diagnostic research. The cabinet and in particular the lacquer decoration have been the subject of macroscopic and microscopic examination: cross-sections were taken to determine the lacquer’s stratigraphy and samples of the lacquer layers have been analysed to investigate the material composition. The results indicate that the cabinet and the lacquer decoration could be contemporary with a late seventeenth- or early eighteenth-century Dutch cabinet-on-stand. However, both the cabinet’s construction and the lacquer decoration have undergone several restorations which can partly be related to the lacquer’s degradation phenomena.

Keywords: European lacquer, imitation lacquer, japanning, Dutch cabinet-on-stand, material-technical analysis, alligatoring

Introduction
This paper presents a case study of a late seventeenth- to early eighteenth-century Dutch cabinet (figure 1) decorated with black European lacquer

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A Dutch seventeenth-century European lacquer cabinet.

(i.e. imitation lacquer), depicting a mix of Far Eastern-inspired and European motifs. The lacquer surface shows various degradation phenomena that affect the lacquer’s original transparency and gloss and the original colours of the underlying decoration (figure 2), significantly reducing the readability of the lacquer decoration.

The cabinet was inscribed in the collection of the Cultural Heritage Agency of the Netherlands (RCE) in 2005, in conjunction with an inventory of the furniture at the Dutch Ministry of General Affairs in The Hague. Unfortunately, this is all that is known about the cabinet’s provenance. The scarce knowledge about the cabinet and the reason for its current appearance required a diagnostic research that was aimed at determining the cabinet’s date and origin of production and gaining insight into the causes of the deteriorated lacquer surface.

**European lacquer**

Far Eastern lacquerware made its way into Europe during the sixteenth century. With the foundation of the United East India Company in 1602 Amsterdam became Europe’s leading trade hub for the Far East, and prosperous economic times followed soon after. The exotic appearance of lacquerware with its highly glossy surface and decorations of sprinkled gold and painted motifs appealed to the European upper classes. Consequently, a constant flow of imported lacquerware was needed to fulfil the ever-increasing demand. Due to the growing popularity of Far Eastern lacquerware, European artisans developed methods that would imitate the expensive Far Eastern lacquer coatings and decoration techniques.

Although European lacquer workers of the seventeenth century had contact with imported lacquerware, they had no access to the natural resinous raw material from the lacquer trees of the Anacardiaceae family which the artisans in the Far East used to produce lacquerware. Therefore, they turned to materials and techniques from varnishing and mimetic practices. Intercontinental trade made a wide variety of inorganic and organic substances available, including plant exudates such as resins (fresh and fossilised), gums, and vegetal oils. The resins and gums that were the ingredients for a lacquer recipe were measured and ground before being dissolved in solvents (spirit varnishes and essential oil varnishes) or dissolved with the addition of heat in drying oils (oil varnishes). By applying these lacquers in several layers onto a coloured or decorated ground with constant polishing in between layers, the artisans were able to produce a lustrous coating that closely imitated its Far Eastern equivalent.

The historical variety of recipes and techniques used for producing lacquer-imitating coatings has been confirmed by previous research on imitation lacquer. The complex nature of imitation lacquer makes the ageing and degradation processes rather unpredictable. Moreover, fluctuating ambient conditions and UV exposure as well as historical treatments can change the original physical and chemical integrity of the lacquer, resulting in an alteration of the original appearance. Examples of these changes include severe yellowing and cracking, which cause surface and internal scattering of incoming light and affect the lacquer’s transparency, gloss and colours.

Because of this diversity of materials and variation in degradation phenomena, it is difficult to predict the lacquer’s composition and comprehend the observed degradation phenomena without macroscopic and microscopic examination complemented by chemical analysis. A deeper understanding of the object is essential to establish a proper proposal for treatment.

The Netherlands’ role as an importer of Far Eastern lacquerware is well known. However, knowledge about the native production of imitation lacquerware is scarce. To date only a handful of Dutch imitation lacquerware objects are known, such as the small casket attributed to Willem Kick in the collection of the Rijksmuseum. Strikingly few objects are identified and preserved in collections in general.

**Figure 2** Detail from the left side panel of the deteriorated lacquer surface.
Description of the cabinet

Construction
The cabinet is composed of a rectangular two-door upper case and a stand (202 x 158 x 57 cm). The stand has four spiral legs on bun feet joined by a spiral X stretcher at the bottom and rails with double-doweled mortise-and-tenon joints at the top, except at the front, which holds a large drawer. The centre of the X stretcher has a diamond-shaped appliqué. All parts of the stand appear to be original, except for the sides, the back and the bottom of the large drawer and the drawer runners. The sides and the doors are a simple construction of vertical planks which seem to be butt-joined or joined with dowels. On the inside of the doors, horizontal imprints in the lacquer are visible in both the upper and lower part of the doors, which may suggest that cleats originally have been a part of the construction. The doors are mounted with secondary pivot hinges; the original hinges have been replaced. The inside of the right door has a variant of a half mortise spring lock. The lock seems to be the original lock; however, it has been re-worked and re-screwed onto the door. The key entrance has been replaced.

The back of the cabinet is constructed of a wooden framework holding six panels. It is assembled of four different common European types of wood: softwood (presumably from the Pinaceae sp.), beech (Fagus sp.), oak (Quercus sp.) and a light hardwood, possibly poplar (Populus L.) (figure 3). All other parts of the cabinet are coated with lacquer decoration. However, softwood can be observed through lacunas in the lacquer at several different locations, which leads to the assumption that the cabinet is constructed of softwood.

The top of the upper case has a cornice with a simple moulding. Two wooden planks joined by tongue and groove and nailed with forged nails cover the top. Two shelves divide the interior space, each with two drawers beneath it. The construction of the drawers is nailed. The backs and bottoms of all four drawers have been restored.
Lacquer decoration
The lacquer depicts buildings, flowers, human figures, birds, and stylised leaf ornaments in green, red, orange and white, and sprinkled and painted metal speckles and powders in various tints of ‘gold’ applied onto a black ground (figure 4).7 The depictions on the doors and on the sides respectively are mirror images. The buildings, some of the birds and flowers, the clothes, and the facial hair of the male humans are of a Chinese nature. However, the eyes of the human figures and the stylised leaf ornaments are of a European nature. The inside of the cabinet also has a black coating.8 The front of the drawers and the doors are decorated with stylised leaf and floral motifs. The stand, including the spiral legs and stretcher, is also decorated with stylised leaf and floral motifs.

Degradation phenomena
The degradation phenomena on the cabinet include cracks, craquelure and crazing, alligatoring and wrinkling, yellowing and darkening, bloom and lacunas (figure 5). There are also areas where the lacquer structure has been lost completely, notably on protruding parts and edges. Large cracks on the doors and side panels run through the whole lacquer structure and in some cases through the wooden substrate. These types of cracks parallel to the wood grain are commonly related to changes in the ambient climate, which lead to a divergent expansion and shrinkage between the wooden substrate and the lacquer. All lacquered parts exhibit various extensive craquelure with both narrow and wide cracks; secondary craquelure (checking) is also visible under UV. The patterns differ in different areas on the cabinet. Most of them are randomly ordered and have no predominant direction; the cracks run parallel, perpendicular, and diagonal to the wood grain direction of the substrate. The cracks are in general smooth, with no jagged edges, and are either straight or slightly curved.8 Both ageing and drying cracks can be distinguished.10 The craquelure of the stand is of a different character: it has an extensive network of fine cracks (crazing).

A number of lacunas in the lacquer surface are clearly visible under UV. The lacquer’s surface is heavily yellowed and darkened, which strongly affects the true colours of the decorations. Many parts of the lacquer show a cloudy surface haze or bloom. In one particular area on the right door, the surface is almost white, reducing the transparency of the top layers significantly.

The most disturbing degradation phenomenon is the surface alligatoring and wrinkling. In the areas along the edges of the side panels the lacquer’s surface has formed into islands with round edges and an increased thickness compared to the surrounding areas. As a consequence of this, the reflective light is scattered, resulting in a significantly less saturated black surface and reduced visibility of the decoration. This affects the contrast between the black lacquer and the brightly coloured decorative elements, which constitutes the essence of the lacquer decoration.

Method
Considering the complexity of the lacquer decoration, a multidisciplinary strategy was used to address the two leading questions of the diagnostic
research: determining the cabinet’s date and origin of production, and gaining insight into the causes of the deteriorated lacquer surface.

Macroscopic examination

Macroscopic examination in both visual (VIS) and UV light is standard procedure for diagnostic research of any art object. This examination provided fundamental information about the cabinet’s construction and finish, including a categorisation of the various degradation phenomena and stylistic features. The macroscopic examination also discovered previous interventions, both in the construction and the lacquer surface. These could be observed through the use of different materials, changes in the construction, tool marks, and retouches of the lacquer. This provided important information when choosing suitable sample locations.

Microscopy of cross-sections and the lacquer topography

A microscopic study of several cross-sections was carried out in order to understand the general stratigraphy of the lacquer and to categorise the various layers according to their respective function: preparatory layer, ground layer, decorative layer and lacquer layer(s). Cross-sections were taken from both the upper case and the stand for a comparative study of the stratigraphy and the different types of degradation. The samples were embedded in a one-component non-fluorescent methacrylate that cures under UV and dry-polished with 12000 grit Micro-Mesh cushioned abrasive. The layer structure was studied and documented by means of optical microscopy under VIS-BF (bright field) and UV. To gain a deeper understanding of the lacquer’s various degradation phenomena the topography was further studied with a 3D-digital Hirox RH-2000 microscope. The 3D-digital microscopy was carried out on the right door, which was chosen as a representative area for different degradation phenomena and decorations.

Chemico-analytical techniques

The chemico-analytical techniques described below were performed with the aim to identify both organic and inorganic materials of the lacquer and their spatial distribution within the lacquer structure.

Organic analysis

Histochemical staining of the cross-sections was performed to identify the organic binding media groups of the different layers in the lacquer’s build-up. Although histochemical staining is a widely recognised low-tech method for the identification of organic compounds, the methodological approach has only recently been optimised for the characterisation of Asian lacquer. By adapting the original methodology it can also be used to detect binding media groups such as protein, starch, protein/oil and oil/lipids in European imitation lacquer. The staining methodology was based upon the procedure presented at the Recent Advances in Characterizing Asian Lacquer (RAdiCAL) workshop by Nanke Schellmann. The original exposure times used for soaking, staining and rinsing cross-sections of Asian lacquers were reduced by applying the solutions in intervals, since some components of European lacquers can be more sensitive to the solutions used.
The following stains were used on the embedded cross-sections (in order of staining): (1) Amido black 10B for proteins, (2) Lugol’s solution for starch, (3) Nile Blue sulphate for oil/proteins, and (4) Sudan Black B for oil/lipids. Before staining, all cross-sections were studied and photographed under VIS-BF and UV using an optical microscope (50x to 500x). These reference images are paramount for the interpretation of the results after staining.

Thermally assisted hydrolysis and methylation-pyrolysis-gas chromatography-mass spectrometry (THM-Py-GC-MS) is a commonly used technique to identify organic components of lacquers.¹⁶ To identify compositional differences between the individual layers of the lacquer structure, the lacquer, ground and preparatory layers were sampled layer-by-layer, allowing layer-unique analysis. Two layer-by-layer sampling methods were executed to collect thirteen individual layer samples directly from the lacquer surface with a small scalpel, and from a larger cross-section using a micro-chisel.¹⁷ Sampling was performed under optical microscopy with alternating VIS and UV to minimise cross-contamination of adjacent layers. Each sample was analysed by THM-Py-GC-MS separately.¹⁸

Inorganic analysis

X-ray fluorescence spectrometry (XRF) was performed as it provides a non-destructive tool to detect inorganic components of the lacquer, such as metal powders and pigments. The right door was chosen as a representative area for the XRF analysis as all the different colours (black, green, red, orange and white paint) and the metallic gold-coloured decoration are present. Additionally, several lacunas in the door’s lacquer layer allowed direct measurements on the preparatory layer. A total of nineteen locations were selected and analysed with XRF.¹⁹ For each location the present layers were measured (e.g. white preparatory layer/black ground/red paint/lacquer) and the absence or amount of lacquer was noted (e.g. ‘measure point without lacquer’, ‘measure point between or on lacquer accumulation’) to be able to compare the spectrum of detected materials. At least two points of each colour and ‘gold’ tint were measured for comparison of the results.

Scanning electron microscope with energy dispersive X-ray spectroscopy (SEM-EDX) was performed on the cross-sections to identify any inorganic components of the lacquer and their spatial distribution within the lacquer structure.²⁰

Results

Stratigraphy and material composition of the lacquer

Three lacquer structures were identified on the cabinet, located on: I. the decorated areas on the upper case; II. the spiral stretcher of the stand; III. the pronounced alligatored areas along the side panels.²¹

I. Decorated areas of the upper case (table 1.I)

The decorated areas on the upper case – the doors and the centre parts of the side panels – seem to have three chalk-based preparatory layers bound with starch and protein. A black ground follows the preparatory layer. A preheated linseed oil was identified as binding medium, possibly mixed with pine resin. The black colouring substance is lamp black (soot). In the painted decorations three pigments could be identified: lead white, verdigris and vermilion. In one sample, however, barium and sulphur were encountered. This may suggest the use of barium white. These elements were only found in the greyish shading of one of the geese depicted on the left side panel (seen in figure 2), which is applied onto a lacquer layer that covers the white paint underneath.

XRF analysis confirmed that the yellow-seeming flowers and the faces of the human figures are in fact pure white (lead white paint), which is also clearly visible under the 3D-digital microscope (figure 6). One sample of paint was taken to analyse the binding medium. This contained linseed oil mixed with about 5-10% rapeseed oil. The 3D-digital microscope revealed fine cracks (ageing cracks) in the painted decorations.

The 3D-digital microscopy in combination with XRF analysis allowed a close-up study of the metallic decoration (figure 7). The metal is an alloy of zinc and copper, i.e. brass. The various tints seem to be obtained by using speckles and powders in varying shapes and sizes, some of which are densely distributed and others more scattered. It was also found that the metal alloy in the more red-tinted areas has a lower content of zinc: ca. 0.7% in comparison to ca. 10-20%.²² Another possibility for the varying tints is the use of a coloured lacquer. Colouring the lacquer with a yellow or red dye is a historically-documented technique used for material imitation also mentioned in recipes for European lacquer.²³ The presence of a coloured lacquer on top of the metallic decoration could not be distinguished microscopically due to the heavily aged and discoloured top layer. Therefore, the use of a
<table>
<thead>
<tr>
<th>Location</th>
<th>Layers</th>
<th>Material composition</th>
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<tbody>
<tr>
<td>I. Decorated areas on the upper case.</td>
<td>Topcoat&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Paraffin and beeswax</td>
</tr>
<tr>
<td></td>
<td>Varnish layer&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Linseed oil, a non-drying oil (raw castor oil and/or rapeseed oil), pine resin, indication of copal, metal driers (Pb, trace of Fe, Mn)</td>
</tr>
<tr>
<td></td>
<td>Varnish layer&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Dammar, pine resin, linseed oil**, non-drying oil**</td>
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<td></td>
<td>Original lacquer layer&lt;sup&gt;4&lt;/sup&gt;†</td>
<td>Results inconclusive</td>
</tr>
<tr>
<td>Decorations</td>
<td>Binding media&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Linseed oil, rapeseed oil, pine resin</td>
</tr>
<tr>
<td></td>
<td>Pigments&lt;sup&gt;1,3&lt;/sup&gt;</td>
<td>Lead white (Pb)</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>Barium sulfate (Ba, S)</td>
</tr>
<tr>
<td></td>
<td>Grey</td>
<td>Mercury sulphide (Hg, S), lead (Pb)</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>Mercury sulphide (Hg, S)</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Verdigris (Cu)</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Brass (Zn, Cu)</td>
</tr>
<tr>
<td></td>
<td>‘Gold’†</td>
<td>Preheated linseed oil, pine resin, soot (lamp black)</td>
</tr>
<tr>
<td></td>
<td>Black ground layer&lt;sup&gt;1&lt;/sup&gt;†</td>
<td>Chalk (Ca), indication of starch, protein</td>
</tr>
<tr>
<td></td>
<td>Preparatory layer&lt;sup&gt;3,4&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>II. Spiral stretcher of the stand.</td>
<td>Topcoat&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Paraffin and beeswax</td>
</tr>
<tr>
<td></td>
<td>Original lacquer layer/ Varnish layers and black ground layer&lt;sup&gt;1&lt;/sup&gt;†</td>
<td>Linseed oil, trace of a non-drying oil (raw castor oil and/or rapeseed oil), pine resin, trace of triterpenoid resin (likely dammar), indication of copal, soot (lamp black)</td>
</tr>
<tr>
<td></td>
<td>Preparatory layer&lt;sup&gt;3,4&lt;/sup&gt;</td>
<td>Chalk (Ca), markers for protein and starch/gum</td>
</tr>
<tr>
<td>III. Alligatorated and non-decorated area along the edge of the left side panel.</td>
<td>Topcoat&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Paraffin and beeswax</td>
</tr>
<tr>
<td></td>
<td>Varnish layer&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Linseed oil, a non-drying oil (raw castor oil and/or rapeseed oil), pine resin, indication of copal</td>
</tr>
<tr>
<td></td>
<td>Pigment layer&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Soot (lamp black)</td>
</tr>
<tr>
<td></td>
<td>Varnish layer&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Linseed oil, a non-drying oil (raw castor oil and/or rapeseed oil), pine resin, indication of copal</td>
</tr>
<tr>
<td></td>
<td>Black ground layer&lt;sup&gt;1&lt;/sup&gt;†</td>
<td>Linseed oil, pine resin, indication of copal, indication of bitumen and/or Kassel earth and coal tar</td>
</tr>
<tr>
<td></td>
<td>Preparatory layer&lt;sup&gt;1,3-4&lt;/sup&gt;</td>
<td>Chalk (Ca), markers for protein and starch, Linseed oil**, pine resin**</td>
</tr>
<tr>
<td></td>
<td>Substrate</td>
<td>Wood (Pinaceae sp.)</td>
</tr>
</tbody>
</table>

<sup>1</sup> Analysed with THM-PY-GC-MS, <sup>2</sup> analysed with XRF, <sup>3</sup> analysed with SEM-EDX, <sup>4</sup> analysed with histochemical staining.

* The layers could not be separated for individual analysis. ** Presence likely due to cross-contamination with adjacent layer.
dye in one of the subsequent lacquer layers cannot be completely excluded without chemical analysis. The painted and metallic decorations are covered with one original lacquer layer, two varnish layers and a wax topcoat. The components of the original lacquer layer could not be identified. The first varnish layer has a clear bluish fluorescence, and contains dammar and pine resin. The presence of linseed oil and the indication of a non-drying oil are likely contaminations from the subsequent varnish layer. This third layer is relatively thick (ca. 60-100 μm). The linseed oil seems to be preheated, likely with the addition of metal driers. XRF analysis shows the presence of lead at all measurement points. Further analysis with SEM-EDX showed lead particles present in the surface of the top varnish layer. No lead was found in the foundation layer. Iron, manganese and zinc were also found in almost all XRF measurements. Like lead they have a higher peak on points of lacquer accumulation. Since no other logical origin of these elements could be found, this might suggest they have been added as driers. SEM-EDX analysis gave no indication of the spatial distribution of these elements.

2. Lacquer on the stretcher of the stand (table 1.II)
The lacquer on the stand has two chalk-based preparatory layers bound with protein and starch. The following black ground layer and subsequent lacquer and varnish layers were not successfully separated for individual analysis. Again, soot was detected. Four transparent layers can be distinguished on top of the black ground. The third layer, with a clear bluish fluorescence corresponds in appearance to the first varnish layer on the upper case in which dammar was identified. The components of the second varnish layer on the upper case are also present in the sample from the stand. However, on the stand this varnish has been applied much thinner.

3. Alligatored area on the side panels (table 1.III)
The cross-section from the pronounced alligatored area deviates from the lacquer stratigraphies described above. The preparatory layer seems to be thinner than on other parts of the upper case, with only two layers instead of three. However, the composition seems to be similar. In the following black ground the analytical results indicate the presence of some black-brown colouring substances, bitumen and/or Cassel brown and coal tar. A thick varnish layer is applied onto the uneven black ground. This layer is composed of raw linseed oil mixed with a relatively high percentage of a non-drying oil, likely castor oil and/or rape seed oil, and small amounts of pine resin and copal. It also contains a thin pigment layer of lamp black. The composition is comparable to the second varnish layer on the decorated areas of the upper case and the stand. A topcoat of paraffin-beeswax is applied on all lacquered parts of the cabinet.

Discussion
The interpretation and contextualisation of the analytical results were carried out with the help of literature studies, historical recipes, and discussions with art historians, colleague conservators, and conservation scientists.

To answer the question whether the cabinet could be contemporary with a late seventeenth- or early eighteenth-century Dutch cabinet we have to characterise its constructional and stylistic features and distinguish original materials from non-original materials. The cabinet’s style and construction correspond strongly to a Dutch cabinet-on-stand called a kruisvoetkabinet: a cabinet on an open stand where the legs are joined by an X stretcher; the legs and stretcher are often spiral-shaped. This type of cabinet seems to have developed from chests placed on open stands and baby linen cabinets in the early seventeenth century and became a standard type of cabinet in the Dutch Republic during the late seventeenth century to the early eighteenth century, when cabinets with closed stands and with drawers became the new fashion. About a handful of somewhat similar cabinets have been found for comparative studies (table 2). They are considered of Dutch origin regarding their construction and the type of wood used. Cabinet A and B have a similar construction as the cabinet in this study. Regarding the lacquer decoration, some are reminiscent of each other, but no direct match of the figurative depictions of the cabinet in this study has been found. Nonetheless, there are three ornamental patterns that can be seen on all four cabinets (table 2). These ornamental elements have not yet been encountered on lacquered cabinets from other European countries like England and Germany. However, more examples are necessary to draw further conclusions. A few things are noteworthy about the cabinet’s construction. What first comes to one’s attention is the framework of the back, which is made of several different species of wood. More commonly the back is of a simpler construction of vertical planks. The painted Dutch cabinets-on-stands are predominantly made of softwood.
Figure 8  A few cabinets with similar construction and partly similar decorative elements of the lacquer decoration.
there is a visible difference in age between the parts of softwood and those of oak, beech, and poplar, where the softwood appears much older than the others. The panels of softwood have longitudinal open woodworm holes, which may suggest that they have been re-planed to be re-used. Tool marks from a circular saw on the parts in beech also support that the framework is of a later date than the cabinet. Moreover, instead of the more typical construction where the side panels of the cabinet stand in a shallow groove between the profile along the top of the stand and what constitutes the bottom of the upper case, the side panels are glued to cleats on the cabinet’s interior which are attached to the top of the bottom (figure 9). Because of this, the doors are in a higher position and therefore a rail is placed under to fill the gap between the profile of the stand and the doors. The rail is joined to the cleats with triangular shaped corner blocks. On the outside the rail is rather eye-catching because of its lack of painted decoration which covers all other lacquered parts. It seems likely that this construction, as well as the framework of the back, is the result of a reconstruction of the cabinet.

When considering the lacquer’s stratigraphy and the composition of each layer, the preparatory layer, the black ground (with exception of the edges of the side panels), the painted decorations and the first lacquer layer, all layers are made of materials that have been used by artists throughout several centuries. The materials also coincided with several results from previous studies of European lacquer and descriptions on lacquer imitation in historical recipes from the late seventeenth and first quarter of the eighteenth century. Hence, the composition of the layers could well be contemporary with a late seventeenth- or early eighteenth-century cabinet. The presence of barium white (barium sulphate) in the shading of one of the geese feathers could, however, not originate from such an early date, since barium white was first developed in the late eighteenth century. The possibility that this shading is part of the original decoration cannot be completely excluded. Considering the presence of the lacquer layer underneath and the indication of a varnish added later on top, it seems more likely that this shading is a retouching which was added later. The presence of rapeseed oil in the paint is notable. Rapeseed oil is seldom mentioned as a binding medium for paint; historically, it was used as lamp oil. Nonetheless, it has been found in some medieval paintings, as well as in twentieth-century paintings. The rapeseed oil may have been added to prolong the drying time of the paint, or it has been used as an adulterant in the linseed oil.

Dammar is first mentioned as an artist material in the beginning of the nineteenth century. The dammar layer is therefore not thought to be original to the cabinet’s date of production. The fact that there is a lacquer layer present underneath makes it plausible that the dammar layer is not original to the lacquer decoration, but was applied as a restoration measure to enhance the gloss of the surface. The areas along the edges of the side panels with pronounced alligatoring clearly have a different stratigraphy and material composition from the decorated areas of the upper case and the lacquer on the stand (table 1). This strongly indicates that these areas were re-worked at some point in the cabinet’s history, likely at the same time as the reconstruction of the cabinet’s back, where oak styles were fitted to the softwood panels as a part of the new framework construction. The analytical results show the presence of bitumen and/or Cassel brown and coal tar in the black ground (table 1). The terms bitumen and coal tar are, together with asphalt/asphaltum, often used interchangeably for a dark brown-black, highly viscous liquid or a solid form of petroleum. It seems like these terms have also historically been used interchangeably, due to their visual and physical similarities. The chemical composition of these materials is complex. The analytical result indicates the presence of coal tar, which can be distinguished from natural asphalt by its pyrene content, indicating that it is a by-product from the coke and coal gas manufacture. The derivation of coal tar from coal was first attempted in England in the late seventeenth century and in the late eighteenth century imputed by the development of coke as fuel. Asphaltum is mentioned in some eighteenth-century recipe books for black imitation lacquer. However, it is not sure if they refer to the natural asphalt or to coal tar. For example, Buonanni (1733) describes asphalt as ‘another good bitumen’ to make black lacquer (‘Vernis noir’); this seems to concern natural asphalt. The more commonly mentioned pigments for black lacquer are lamp black and ivory black. Recipes for black lacquers made with pigments, asphaltum, or coal tar can also be found in nineteenth- and twentieth-century sources.

The composition of the oil-resin varnish on top of the black ground is similar to the top varnish on the rest of the upper case, with the exception that a raw linseed oil has been used instead of a preheated linseed oil. Both top varnishes contain a non-drying oil, likely castor oil and/or rape seed oil. Castor
oil is a non-drying oil made from the seed of the plant Ricinus communis. The oil has been used since ancient times as lamp fuel and for various medical purposes. Castor oil has unique physical and chemical properties due to three functional groups - a hydroxyl, a carboxylate and a carbon-carbon double bond - in its major component, ricinoleic acid. The hydroxyl groups make castor oil soluble in alcohol and endow it with a high viscosity. Its properties make castor oil an important raw material for many industrial applications, among others as a plasticiser, which is also thought to be its intended function in the oil-resin varnish. Castor oil does not seem to be commonly mentioned in cabinetmakers’ or artists’ recipe books. In this study, it has not been encountered as an ingredient in any recipe books concerning lacquers or varnishes for cabinetmakers or artists before the nineteenth century. In a few nineteenth- and twentieth-century recipe books for wood varnishes, castor oil was used as an ingredient in spirit varnishes and celluloid lacquers.

What could have caused the deteriorated surface?

Having gained knowledge about the lacquer’s stratigraphy and composition, we can relate the materials to the various degradation phenomena and thereby better understand what could have caused them. The wide range of coating failures that may be the cause of the visual and structural changes of the lacquer can be related to a number of factors: variables during manufacturing, such as ingredient preparation; processes during or shortly after application; processes during or shortly after setting or drying; previous interventions; environmental exposure; or simply natural degradation or use. The majority of the materials used in European lacquer systems are organic, and the fundamental cause of their degradation is oxidation.

Craquelure and lacunae

Regarding the five different types of craquelure identified in the lacquer surface, two types of cracks can be characterised: ageing cracks and drying cracks. The ageing cracks can be related to embrittlement of the resins and drying oils as a result of natural ageing and degradation, whereby these materials become less able to withstand environmental fluctuations. The cracks in the dammar lacquer may also have occurred due to stress developed by the subsequent alligatored oil-resin varnish. The drying cracks are confined to the top oil-resin varnish and their occurrence are, as the name implies, related to the chemical and physical actions of the drying process that induce internal mechanical stress. Embrittlement and craquelure in the lacquer’s surface are a starting point for the occurrence of lacunae. Adhesive failure between layers due to material incompatibility or degradation processes and temporarily applied external forces on the lacquer’s surface are other likely causes for the creation of lacunae.

Alligatoring and wrinkling

The principle cause of alligatoring is the contraction of a rapidly drying top layer over a slower drying underlying layer. The more rapid-drying surface layer hampers oxygen absorption and possibly solvent evaporation of the underlying layer, leading to a difference in drying rate between the two, and causing the surface to contract the still-soft underlying materials into islands. Alligatoring is thus related to a difference in drying rate between layers or within a single layer that has been applied too thickly. The latter seems to be the case on the cabinet. The top oil-resin varnish is of a notable thickness; it may have been either applied as one very thick layer, or in several layers, but without sufficient drying time between the applications. A difference in drying rate can also be induced by the inclusion of driers, phenol-containing tars and pigments, non-drying materials, or slow evaporating solvents. Coatings containing a drying oil, such as linseed oil, are particularly prone to alligatoring due to their drying process by oxidation, which is at its highest at the oil-air interface. Considering the material composition of the varnish in the areas along the edges of the side panels, i.e. the coal tar and bitumen/Cassel brown, the linseed oil, the non-drying oil, and the lampblack are all contributors to a decreasing drying rate.

Yellowing and darkening

The yellowing and darkening seem to primarily confined to the top oil-resin varnish. Yellowing and darkening are especially observed in oils with a high content of linolenic acid, such as linseed oil, which is the main component of the top oil-resin varnish. It is also generally known that many resins also have the tendency to yellow and darken with age. The yellowing and darkening of ageing linseed oil has been attributed to autoxidation, thermo-oxidation, and co-oxidation of contaminants, but many questions about these processes remain unanswered. Other materials that may be present in the varnish, such as pigments, dyes, and metal driers, are also likely to be involved in
A Dutch seventeenth-century European lacquer cabinet.

Summarising the results, parts of the cabinet and its lacquer decoration could definitely be contemporary with a late seventeenth- or early eighteenth-century Dutch cabinet. The cabinet and the lacquer seem to have undergone two or three restorations. Based on the identified materials, these treatments appear to have been executed at the earliest in the nineteenth century. The first restoration can be linked to the use of barium white for retouching and the application of the dammar varnish. The second restoration can be related to the reconstruction of the backside framework and the addition of the top oil-resin varnish, including the re-made areas along the edges of the side panels. The wax coating is possibly the result of a third restoration or maintenance.

The degradation phenomenon that affects the lacquer’s appearance the most is the alligatoring. It confines to the non-original top varnish layers. The cause of the alligatoring can be related to the combination of materials and the layer thickness of the top oil-resin lacquer, where the more rapidly-drying surface layer hampered oxygen absorption and possibly solvent evaporation of the underlying layer, leading to a difference in drying rates between the two, and causing the surface to contract the still soft underlying materials into islands.

Further research

Although new insights were gathered, several questions remain. Further analytical and art historical research should focus on gathering in-depth information to refine the timeline of events related to the cabinet’s history, particularly the remaining uncertainties regarding the material composition of the original lacquer layer on both the stand and the upper case. In addition, a more in-depth material-technical and art historical study of comparable lacquered objects should be performed to gain better understanding of their art historical context and to broaden the knowledge of Dutch lacquer. More information will support the arguments for the cabinet’s date and place of production.

The cabinet’s present appearance does not meet the aesthetic requirements for display. Therefore, treatment of the lacquer surface is desirable to improve its appearance. The results of this diagnostic research provide a starting point towards discussion and further research on possible treatment.

Acknowledgements

We wish to thank Ron Kievits, Henk van Keulen, Dr. Ineke Joosten and Dr. Klaas-Jan van den Berg at the
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Notes
1 During the course of this study the cabinet was transferred to the Rijksmuseum Amsterdam collection, inv. nr. BK-2017-37.
3 In Britain and North America the art of lacquer imitation is often referred to as ‘japanning’.
4 There are several historical recipe books and treatises discussing the art of lacquering and imitation lacquer, e.g. Salmon 1672 and 1710, Stalker and Parker 1688, Traité de la peinture en mignature 1708, Buonanni 1720, Watin 1755, Dossie 1758 and 1764.
5 Most studies on European lacquers have been carried out within three large-scale research projects: the German-Japanese research project on the investigation and restoration of lacquers, Characterization of Asian and European Lacquers, and European Lacquer in Context; the latter two are still on-going. Publications of the German-Japanese research project on the investigation and restoration of lacquers can be found in Walch, Katharina, Johann Koller 1997, Kühlenthal 2000a and Kühlenthal 2000b, see also ‘Characterization of Asian and European Lacquers’, ‘European Lacquer in Context’.
6 Attributed to the Dutchman Willem Kick (Amsterdam, 1579-1647). One is dated 1618, collection Rijksmuseum Amsterdam (inv. nr. BK-2007-6).
8 The black lacquer on the cabinets inside (except the drawer fronts and doors) seems to be covered by black high gloss paint, which is probably not original. In consultation with the Cultural Heritage Agency of the Netherlands materials analysis was focused on the exterior. Further research is necessary to determine the composition of the interior coatings.
11 Due to the limitations on the paper’s length, no technical details of the analytical instruments and chemical analysis are given. Please contact the corresponding author for questions regarding the former.
12 Technovit 2000 LC.
14 Schellmann 2012b.
15 There is a risk of swelling, leaching and dissolving certain layers, in particular the preparatory and isolation layers, which might contain water-sensitive binder types such as fish glue (isinglass), starch or gums. To detect any negative interaction between the samples and the solutions used, the sample’s condition needs to be observed continuously with optical microscopy throughout the staining process.
18 The THM-Py-GC-MS analysis was performed by Henk Van Keulen, senior specialist gas chromatography-mass spectrometry at the Cultural Heritage Agency of the Netherlands.
19 The XRF analysis was performed together
with Jan Dorscheid, furniture conservator at the Rijksmuseum. The results were further discussed with Prof. Dr. Arie Wallert at the Rijksmuseum.

The SEM-EDX was performed by Dr. Ineke Joosten, conservation scientist at the Cultural Heritage Agency of the Netherlands.

The number corresponds to the layers in the cross-sections/stratigraphy shown in table 1.

To estimate the ratio between the copper and the zinc, the XRF spectra were deconvolved with an open source software (PyMca 5.1.1) by Arie Pappot, PhD candidate in metals conservation at the Rijksmuseum/University of Amsterdam.

The number corresponds to the layers in the cross-sections/stratigraphy shown in table 1.


Note, an additional varnish layer is applied onto the greyish shade (cross-section I., table 1).

Due to cross-contamination.

Piena, in press.

Piena, in press.

Piena, in press.

See for example articles in Kühenthal 2000a and Kühenthal 2000b, for historical art technological examples, see Stalker and Parker 1688, Salmon 1701 and Dossie 1764.

Eastaugh 2008: 46.

Van Keulen 2014.

These terms are often confused with tar, wood tar, pitch, peck, and mummy.

Carlyle 2001: 530 (footnote 7).


Buonanni 1733: 17.

See for example Stalker and Parker 1688: 19-21, Salmon 1701: 877, 890-892, Dossie 1764: 419.


Nunn 1996: 140, 144.


Karak 2012.


The fine and narrow ageing cracks in the painted decorations, ageing cracks in the surface of the dammar varnish, drying cracks in the oil-resin varnish, a secondary craquelure (checking) in the oil-resin varnish and a fine-lined craquelure (crazing) on the stand.

De Willigen 1999: 15-16.


AIC wiki ‘White surface hazes’.

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Imitating aventurine: an eighteenth-century technique of lacquer imitation

Tristram Bainbridge

Abstract
The technique of aventurine was used on japanned decorative schemes throughout eighteenth-century Europe. Presented here is a case study of its replication on a German writing cabinet currently (November 2016) on display in the Victoria and Albert Museum’s Europe 1600-1815 Galleries.

The cabinet (W.62-1979) was made in Dresden around 1745-1749, with the japanning decoration attributed to Christian Reinow (1685-1749) (figure 1). It was most likely made for Heinrich, Count von Brühl (1700-1763), the most powerful politician at the courts of Saxony and Poland. It is recorded in the inventory at Brühl’s Schloss Seifersdorf in 1765. The cabinet features large areas of aventurine framing the blue japanning. The technique gives a highly polished, golden glittery surface. As with many of the japanning methods, this western technique evokes a specific Asian aesthetic. It closely resembles the Japanese decorative lacquer technique of nashiji, where randomly shaped gold and silver flakes are evenly sprinkled on the lacquer, with subsequent layers of yellow-tinted lacquer.

Microscopic cross-section analysis of the cabinet’s aventurine surface revealed a method consistent with other well-documented objects and interiors. Silver-plated copper flakes are embedded in a natural resin varnish with further layers of yellow-coloured varnish on top (figure 2). XRF analysis confirmed the presence of copper and silver in the flakes. Close-up images of the individual flakes show the thin layer of silver and the copper underneath (figure 3). Striations along the length of the flake indicate that the copper was drawn into wire and then flattened into ribbons. Böckelmann describes the process of wrapping the wire around a spool in order to cut the ribbons into small squares and the ragged cut edge is visible in the image.

The cabinet was conserved as part of the Victoria and Albert Museum’s Europe 1600-1815 gallery refurbishment project. An extensive treatment involved the consolidation of the japanned surface, retouching losses and cleaning of the brass mounts. The bottom section’s front corners had an ovolo moulding that was conspicuously missing its aventurine decoration. Both left and right sections of the moulding were covered with a thick layer of varnish that appeared to have blackened with age (figure 4). This was likely to have been due to the oxidation of a bronze powder paint that had been applied over the missing and damaged decoration. Some of the original decoration was visible where the overpaint had chipped away, however it appeared to be in very bad condition. Further cross-section microscopy confirmed this, with multiple layers of overpaint mixed with metallic (bronze) powder and flakes.

As one of the star furniture objects in the gallery there was a desire to improve the visual appearance and legibility of the design. On the upper section of the cabinet there were a small number of losses, but for the most part the aventurine of the ovolo moulding remained intact. This resulted in a visual

Figure 1 Writing cabinet, Dresden ca. 1745-1749, (W.62-1979), after treatment.
interruption and disconnection of the aventurine running from top to bottom.

Initial solvent testing revealed the difficulty in removing the overpaint without damaging the underlying layers. On inspection of the more successful test areas, the original decoration appeared in such bad condition that the best option would be to replicate the decoration and not remove the overpaint.

This decision meant that the replicated decoration would have to fulfil a certain number of criteria. Of primary concern was that the replica should not interfere with the original surface. This precluded building up layers of new aventurine varnish over the losses. Any replacement should also be readily identifiable as such. This led to the development of the idea that the new material should be a separate and easily removable layer using synthetic and stable materials.

**Replication of the aventurine**

Two materials were trialled for the creation of a film that could be applied to the object: acrylic dispersions and epoxy resins. One can make effective films using the acrylic dispersion Lascaux 498 HV by spreading the adhesive spread out on to silicone release polyester film using a glass rod. The film dries clear and flexible. Various materials were trialled for the replication of the silver-plated copper flakes. Modern epoxy-coated aluminium foil glitter can be purchased in a variety of square sizes. However, when these were used it was difficult to replicate the randomness of the original and it appeared too uniform. Pure gold Japanese nashiji flakes proved to be more effective: although they are not square but randomly shaped they gave a much closer impression to the original design. An equal mixture of size 6 and size 8 nashiji flakes were used.

For the replication the 498 HV was tinted using Orasol metal complex dyes mixed as 2% w/v solutions in denatured alcohol. A set of dyes was made

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**Figure 2** Cross-section photomicrograph under visible (top) and UV (bottom) illumination showing the metal flakes embedded in a white fluorescing varnish with subsequent layers of orange fluorescing varnish.

**Figure 3** Close-up photograph of the aventurine surface (top) and photomicrograph of a single aventurine flake, approximately 2.5 mm square.

**Figure 4** The whole front corner section of ovolo moulding was damaged and missing aventurine.
up in pipette dropper bottles so that a dye recipe could be accurately developed and repeated. Orasol Brown 2GL (now Brown 322) and Yellow 2GLN (now Yellow 152) were used in a ratio of 1:40 per 10 g of acrylic and 2 g of nashiji flakes were mixed in. When spread out thinly and evenly the resulting film was approximately 160 x 35 mm.

The acrylic film proved highly effective in restoring the smaller losses over the cabinet. The film could be easily cut out with a scalpel and adhered using a heated spatula and more 498 HV adhesive. However, the flexibility of the film proved to be a problem when trying to scale up the films to the larger section of ovolo decoration. For this a more rigid and durable material was required and so epoxy resins were then trialled.

Initial experiments in casting the epoxy straight on to a polyester film were not successful, especially the silicone-coated film that caused the epoxy to bead up. Greater control over the film was achieved by making a RTV silicone rubber mould to contain the epoxy (figure 5). The silicone was cast over a 1 mm thick piece of Perspex in order to create a thin tray, 600 mm long and 30 mm wide.

The nashiji flakes were used in the same proportions as the acrylic films, however, they tended to sink in the epoxy so the flakes had to be sprinkled out on the silicone mould using a funzutsu, a bamboo tube with a mesh covering one end. In Japanese lacquerwork these tubes with different mesh sizes allow the craftsman to have great control over density and evenness of sprinkling. In this case accuracy was not so critical: simply a dense and even carpet of flakes on the surface of the silicone (figure 6).

Some epoxy resins yellow more than others, but in this scenario a small degree of yellowing was not considered to be an issue. Fynebond epoxy was used, although studies have shown it may not be the most resistant to yellowing. Once adhered the final colouring of the films was achieved using Laropal A81 in a 10% w/v concentration dissolved in a 3:1 mixture of Shellsol D40 and trimethylbenzene, tinted with the Orasol dyes. Having this layer of dark colour was reassuring because if the epoxy yellowed significantly in the future, the Laropal varnish could be removed and the appearance lightened.

The epoxy was mixed according to the manufacturer’s instructions and then tinted, again using the Orasol dyes in denatured alcohol. The mixture was poured into the mould with the walls of the impression helping to contain the epoxy evenly rather than creating a specific thickness. The actual thickness of the film was around 0.5 mm, although it would have been possible to abrade the film thinner if required. Fynebond takes 36-48 hours to cure at typical room temperature. After around 30 hours the epoxy was no longer tacky and could be removed from the mould but was still very flexible and could be stretched. This was useful for working on small areas but would have been harder to handle on the long ovolo sections. After 48 hours the strips were fully cured and hard.

Once fully cured the epoxy strips could be made flexible again with gentle heat from a hair dryer. This way they could be cut to the correct size and simply moulded in place with heat (figure 7). As the epoxy cooled it retained its moulded shape. An adhesive was required that would have high tack and preferably a degree of heat-set to hold the strips
in place as they cooled. It also had to be completely removable in the future and cause no damage to the object’s surface. Mowilith 50 polyvinyl acetate 35% w/v in toluene had the correct adhesive properties, long-term stability and the historical surface was not sensitive to aromatic hydrocarbons.

As the strips were not fully opaque, a background colour also had to be applied to the object. In order not to introduce an additional layer into the adhesive system that could be the cause of failure in the future, the colour was incorporated into the Mowilith 50 by mixing in an amount of yellow ochre earth pigment. The adhesive was applied to both the object and the strip. Five minutes after application the surfaces became touch-dry and as the strip was placed on the object an instant contact bond was made. The strip was moulded in place using the hair dryer and a bone folder to apply pressure. With a glass transition temperature of around 35-45 °C the Mowilith 50 also softened under the heat and as the epoxy and adhesive cooled a strong bond was achieved. With its solubility in toluene the strips can be easily removed.

Once in place any joins in the epoxy strip could be covered using Mowilith 50 and some sprinkled nashiji. The colour of the strips was generally the correct hue but needed darkening with the Laropal A81 and dyes to match the original (figure 8). After the Laropal had fully dried the gloss could be modulated using a 1:1 mixture of beeswax and carnauba wax dissolved into a paste with the aliphatic hydrocarbon Shellsol D40. Proprietary paste waxes had to be avoided, as any aromatic content would disrupt the Laropal layer.

During the trial runs the gold flakes could be easily extracted from the epoxy using dichloromethane. The ease of dissolution was time dependent as the epoxy slowly cross-links. Up to 48 hours and the epoxy from offcuts and trial runs would dissolve completely, any longer and the epoxy would swell and become rubbery, but still release the flakes.

The treatment solved the aesthetic problem on the cabinet caused by the loss and overpainting of the original aventurine. On close inspection the imitation does not deceive the viewer but succeeds in giving a coherent overall effect. In a similar context where any future yellowing of the epoxy would be noticeable, Hxtal NYL epoxy could be substituted. The treatment was relatively time-effective and it demonstrates another appropriate use for epoxy and acrylic films in loss compensation.

Figure 8  Detail of the base corner moulding before (left) and after (right).
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Notes

1 V&A catalogue note http://collections.vam.ac.uk/item/O58195/writing-cabinet-reinow-christian/ (accessed 02/12/16).

Caption credit lines

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Suppliers

• Orasol dyes, Laropal A81, Mowilith 50: Kremer Pigmente
• Nashiji gold flakes: Watanabe Shoten Ltd. Japan (www1.odn.ne.jp/l-lacquer/home_eng.html)