FUTURE TALKS
017
THE SILVER EDITION.
VISIONS.
INNOVATIONS IN TECHNOLOGY
AND CONSERVATION OF THE MODERN

TIM BECHTHOLD
EDITOR
ABSTRACT
This paper discusses the decision-making process and the conservation treatment of *Nigritella Nigra* (1993), a chest of drawers designed by Alessandro Mendini (Milan, 1931-2019). The top drawer case is decorated with several colourful abstract crayon drawings, making the chest a unique work of art. The varnish on top of these drawings was peeling off, lifting the crayon with it, with loss of material as a result. This study analyses the factors that may have contributed to the degradation process and describes the research performed preceding treatment, including ethical, aesthetical and artistic perspectives. Information from an artist interview has enriched deliberations in decision-making. For material analysis Py-GC/MS and FTIR were used, identifying grease crayon as medium for the drawings and cellulose nitrate (CN) for the varnish. Various options for consolidation and retouching were considered and tested, and a suitable approach was found with satisfactory result.

KEYWORDS
*Alessandro Mendini, artist interview, grease crayon, cellulose nitrate, Acrylkleber 498 HV (Lascaux®), Medium für Konsolidierung (Lascaux®)*

INTRODUCTION
In 2016 the Rijksmuseum Amsterdam accepted the donation of a colourful piece of furniture by art historians Johan Ambaum (1931-2018) and Frans Haks (1938-2006), the latter being the former director of the Groninger Museum. The chest of drawers is entitiled *Nigritella Nigra* and designed by the Italian architect and artist Alessandro Mendini (Milan 1931) in 1993. Mendini’s work is often associated with postmodernism. His designs are characterised by the use of contrasting materials and vivid colours in joint collaboration between artists, artisans and architects. Decoration and craft play a key role. As such, *Nigritella Nigra* is exemplary, as art historian Peter Weiß explained, considering it an important piece in Mendini’s oeuvre, “a strong postmodern statement of his design-cosmos.”

The chest is handmade and composed of five different encaised drawers stacked onto a low base, decreasing in size towards the top. The boxes are centred and aligned at the back, designed to place the object against a wall. Various types of manufactured board are used, some decorated with paint, others with wood, metal leaf, high-pressure laminate (HPL), and glass mosaic. The top drawer case is covered with colourful crayon drawings on all visible sides and finished with a transparent varnish (Figure 1). Whereas most of the object was still in fairly good condition, the top drawer case was not. The pictorial layer of the drawings showed severe cracks, cupping and flaking. The cupping varnish had locally pulled away the crayon, resulting in numerous losses all over the surface (Figure 2).

This study discusses object’s history, its material composition, and degradation phenomena, as well as the concept of the artwork, the artist’s opinion on its condition and the technical possibilities for conservation, to finally arrive at decision-making, testing, and treatment. The main challenge was to consolidate the brittle varnish that was peeling off, taking the crayon with it. Different products and methods were tested to consolidate the flaking varnish, while different approaches for retouching were considered, taking aesthetical, historical, and ethical perspectives into account.

FURNITURE FOR THE MUSEUM MARKET
*Nigritella Nigra* is part of the *Museum Market*, Mendini’s furniture collection produced by the Design Gallery Milan in a limited edition meant for the museum market. With a nod to agricultural produce and the market, all pieces of furniture were named after a different flower. *Nigritella Nigra* is a type of orchid. A special feature that sets this piece apart from the rest
of the series, are the handmade drawings on the top drawer case. As they all differ, each version of *Nigritella Nigra* is unique.

The drawings are not made by Mendini himself, but by Lucio Giudici, a young man with Down syndrome. Mendini recalls that he first saw the drawings during a visit to the psychiatric hospital where the boy lived, near Trieste, Italy. "This young guy was drawing a lot of drawings with beautiful colours. I asked whether I could use them and paid him some money."(4) It was only years later that he used them to decorate the top drawer cases of each piece in the *Nigritella Nigra* series.

Although the *Museum Market* catalogue states that *Nigritella Nigra* has been produced in one series of twelve pieces, comparative research indicates that there are two series. In addition, a prototype is known, now part of Die Neue Sammlung - The Design Museum in Munich, purchased from a private collector in 2011.(5) According to Weiß, Mario Godani of the Design Gallery Milano mentioned two series of 12 pieces, which had both sold out.(6) Comparing the pieces that could be traced, reveals that the two series can be distinguished by the different decoration patterns on most drawer cases (Figure 3).

### CONDITION OF THE TOP-DRAWER CASE

Except for the prototype, the top-drawer cases from all of the *Nigritella Nigra* chests that could be located have similar degradation phenomena.(7) On chest nr. 5/12 the drawings have "local retouching of losses that also seem to have involved local lifting of the resin layer."(8) Nr. 9/12 has "a flaking surface finish on the paper drawing."(9) Nr. 5/12 from the other series shows similar degradation phenomena: "the wax crayon lost contact with the paper and the wax application frees itself of the paper."(10) From these observations it could be suggested that this problem could be the result of incompatible use of materials. To support this assumption, the first phase of the investigation was the identification of the drawing materials.

Fourier Transform Infrared Spectroscopy (FTIR) revealed that the varnish on the top drawer case of *Nigritella Nigra* nr. 1/12 is a cellulose nitrate (CN) lacquer.(11) CN is notorious for its instability and has a tendency to disintegrate over time, which is strongly affected by exposure to UV, heat, and humidity. Decomposition can become autocatalytic by the initial breakdown products, resulting in shrinkage and distortion. Other causes of structural deterioration are the loss of plasticisers and stress cracking as a result of shrinkage (Selwitz, 1998: 7), phenomena that are clearly visible on the top drawer case.

Pyrolysis gas chromatography/mass spectrometry (Py-GC/MS) of a sample of the drawing material indicated that grease crayon was used. Grease crayon is predominantly composed of paraffin wax, pigments and tallow (Ellis and Yeh 1998: 50). Wax is usually considered a chemically stable material, but it is known to become problematic in laminated structures (Mills and White 1994: 49).(12) Another well-known phenomenon is the migration of free fatty acids, causing a deposition of hazy irregular crystalline particles onto the surface of wax containing artefacts (Ordonez and Twilley 1997: 416A). Yet, none of the examples found in the conservation literature considers the combination of grease crayon with a varnish layer, which makes the case of *Nigritella Nigra* rather exceptional.

Mendini claimed that the varnish was applied with a brush.(13) However, reconstruction tests showed that applying a CN varnish with a brush or roller smeared the crayon as the CN varnish dissolves it. (Mol 2017: 26). This explains the merging of layers observed underneath the flakes that were lifted off the paper substrate. Since the crayon on the drawings of *Nigritella*...
Nigra is partly dissolved into the varnish, but not smeared over the surface, it can be assumed that the CN has been sprayed onto the surface. The absence of brushstrokes or roller marks supports this assumption. In order to determine what factors may have additionally contributed to the deterioration of the drawings on the top case, the work’s history is assessed.

NIGRITELLA NIGRA NO. 1/12

Little is known about the first years of the life of Nigritella Nigra no. 1/12, now in the Rijksmuseum collection. However, since 2001 the chest has had a prominent position in the apartment of former owner Frans Haks and Johan Ambaum in Amsterdam for 15 years. Haks had appointed Mendini as the designer for the new building of the Groninger Museum in 1994. When he and his partner moved to Amsterdam, Atelier Mendini designed the ground floor of their new apartment. A remarkable detail was a sunken bathtub right in the middle. Nigritella Nigra was positioned at a distance of less than two meters from the bathtub, facing it as the centrepiece of the room (Figure 4).

Ambaum confided that Haks took a bath daily, a routine that must have caused the relative humidity in the room to fluctuate, as there was little buffering material in the apartment. The walls and the floor are made up of glass terrazzo and granite (Casciani 2011: 124). The hygroscopic organic materials of the chest itself must have reacted instead, swelling and shrinking at different rates in response to the fluctuations in relative humidity. With CN becoming more brittle over time, it ceases to be able to adapt to such changes in volume, which leads to cracks. Craquelures facilitate moisture and oxygen to penetrate the structure, inducing an autocatalytic degradation process, ultimately disrupting the entire CN film.

ARTIST INTERVIEW

It was important to know whether the object’s condition had affected the artwork’s meaning. Apart from art historical research and consultation with curators and conservators at the museum, it was considered necessary to consult the artist. A semi-structured interview was prepared to enquire about Nigritella Nigra,
When explaining that there are losses in the drawing, Mendini replies spontaneously that he likes the idea of time becoming visible in this work.

Alessandro Mendini (AM):
In my opinion it could remain like this. I find it interesting to see the passage of time in the drawing.

Tirza Mol (TM):
Yes. So, no inpainting or retouching?

AM:
It depends on the politics of the museum....
I like it when an object becomes old, with storia.[...]

TM:
If we don’t do anything it may continue to flake.

AM:
Of course.

TM:
and eh...

AM:
Bene. [Looks at the camera, smiling].

TM:
How far could it go for you before you say it is enough?

AM:
Maybe in one hundred years it has become white.

Benissimo! (Laughter) (19)

Although Mendini suggests that decisions about conservation are theoretical problems as well, mitigating his personal voice, both he and his brother like the idea of the top drawer case becoming white over time, comparing it – once more – to a temple and the way these too have become white over time.

However, upon presenting a more detailed photograph of the drawing in raking light, showing the severe cupping, these initial thoughts are left aside and the conversation leads to the desire for active intervention. Notwithstanding the artist’s general thoughts about material degradation, it became clear that he would not object to consolidation of the pictorial layer. On the contrary, he was in favour of retouching the drawing as well. (20)

DECISION-MAKING
In consultation with the museum staff and in accordance with the artist, it was decided that the conservation treatment should include consolidation to avoid further damage, and retouching to serve its aesthetic appearance. The interview made clear that Mendini had designed Nigritella Nigra as a temple for artistic freedom. The top is meant to be the most sacred place of the ziggurat shaped drawer chest and this idea is no longer expressed with damaged drawings and flaking varnish.

Therefore, the option not to retouch the lacunas to leave the object’s history visible was left aside. It was considered to use a monochrome colour matching its surroundings as a seemingly neutral way of retouching, leaving the intervention visible. However, a digital impression of such an intervention made clear
that the effect would be rather disturbing to the overall image (Mol 2017: 62). The nuances in colour and texture of the crayon turned out to be so significant for the visual appearance of the drawings that ignoring this texture seemed worse than not intervening at all. Finally, the choice was made for integral retouching to visually enhance the top drawer box.

This choice may seem to neglect the object’s inherent material properties, as the degradation phenomena seem to be intrinsic to the original materials used. Climate fluctuations in the room where the chest had been in use for fifteen years have adversely affected its condition. However, this part of the object’s history does not add to the meaning of the artwork itself and can be disclosed by other means.

It can be concluded that the object’s functional, aesthetic, and conceptual characteristics will be greatly improved by a conservation treatment that includes consolidation and retouching of grease crayon drawings on the top drawer case.

ASSESSING CONSOLIDANTS

Adhering the brittle cupped CN flakes with grease crayon back to the paper substrate was a challenge. Paraffin wax is an extremely hydrophobic material (Feist, Little, and Wennesheimer, 1985). In theory the grease crayon film will protect both the paper substrate and CN from the adverse influence of humidity. However, this combination of materials complicates consolidation options. No heat could be applied to use the thermoplastic properties of CN, as the glass transition temperature (Tg) of paraffin wax (40-65 °C) is far lower than the Tg of CN (145-152°C) (Horie 2010: 127; Shashoua 2008: 237). The use of a solvent that plasticises the CN temporarily to facilitate pushing the flakes back in place was no option either, as CN is only soluble in solvents that dissolve the grease crayon adhered to it. Therefore, the solubility parameters of grease crayon limited the range of possible adhesives to water-based types.

The consolidant required demonstrating good adherence to grease crayon, excess material to be easily removable, and minimal shrinkage upon curing. In addition, low viscosity was important to allow for penetration into the network of cracks by capillary action. Finally, the consolidant had to have good ageing properties. Based on the literature, the following adhesives were selected as performing well on fatty surfaces: Aquazol 200 (Arslanoglu 2003: 12); Mowilith DMC2 (Lascaux) and Mowiol 4-88 (Lang 2011: 4); sturgeon glue and fish glue (Lang 2011: 4). In addition, the acrylic dispersion glues Medium für Konsolidierung (MfK) (Lascaux), Acrykleber 498 HV (Lascaux), and Acrykleber 303 HV (Lascaux) were selected as being suitable to consolidate CN (Shashoua 2008: 216). These products were tested on sample CN flakes and then clamped onto a grease crayon covered piece of cardboard. The adhesives were not diluted too much, as high tack is necessary on the greasy surface, while the water percentage was kept to a minimum. Only Acrykleber 498 HV and Acrykleber 303 HV were diluted with demineralised water at 50% v/v because of their viscosity.

MfK and Acrykleber 498 HV showed good adherence already after 5 minutes. Sturgeon glue (8%) and Mowilith DMC2 needed approximately an hour to dry and performed well. Both Aquazol 200 (10%) Mowiol 4-88 (8%) did not adhere the flakes at all. Acrykleber 303 HV remained tacky for days due to its low Tg and was not tested further. Ready-made fish glue turned yellow after drying and was also left aside. Acrykleber 498 HV, MfK, Mowilith DMC2, and sturgeon glue performed well and were further tested on their workability, reversibility, shrinkage, and ageing properties.

The ease of removal of excess material was tested with a cotton swab moistened with demineralised water both immediately and 24 hours. All consolidants were removable with water immediately. This was still the case after 24 hours, except for MfK, but that could still be removed with ethanol.

Shrinkage was evaluated by applying the adhesives onto two strips of Melinex, of which one was artificially aged to evaluate transparency upon ageing. The translucent Melinex substrate demonstrated that Mowilith DMC2 turned milky after curing.
Sturgeon glue showed significant shrinkage after solvent evaporation, distorting the Melinex substrate. Acrylkleber 498 HV and MfK retained their transparency and did not shrink. These two acrylic dispersion glues were finally tested on each of the grease crayon colours on the actual object. A tiny droplet of the adhesive was left on the surface and visually examined with a Hirox 3D microscope for possible physical alterations, such as selective leaching and formation of tidelines. Both adhesives did not alter the grease crayon. Finally, long-term adherence was tested. Two CN sample flakes were adhered to a grease crayon covered paper strip, one with Acrylkleber 498 HV and one with MfK. The two strips were artificially aged in a Xenon lamp test chamber. After ageing both samples performed well and still showed good adherence.

The overall test results led to the choice for Acrylkleber 498 HV 50% v/v in demineralised water to be applied with a fine brush, while the small cracks were filled with the less viscous undiluted MfK by use of a syringe. The flakes were carefully pushed down with the tip of a finger, allowing for the body temperature to help plasticise the cupped CN particles. This method proved successful for consolidation of the entire pictorial layer.

RETTOUCHING

The next step was retouching, which would also stabilize the consolidated areas. To protect the grease crayon remains on the paper surface, an isolation layer was required to ensure reversibility of the retouching. Several water-based glues were tested and sturgeon glue (8%) performed best. It adhered well, dried in a clear transparent film, and remained easily removable with water (Mol, 2017: 138-141).

The retouching medium had to be compatible with the isolation layer and to remain soluble in solvents that do not dissolve the isolation layer, nor the CN varnish. Furthermore, it had to have excellent ageing properties and allow for variation in opacity and imitation of the crayon texture. Based on these requirements the following products were selected, tested, and evaluated on their visual performance, adherence, and reversibility: pigments in Paraloid B72, QoR Watercolors, Golden Fluid Acrylics and Gamblin Conservation Colors.

All products adhered well to the sturgeon glue isolation layer. QoR Watercolors and Gamblin Conservation Colors dried even and matte, making it hard to imitate colour nuances, and impossible to create a structured surface. Pigments in Paraloid B72 dried rather translucent, while Golden Fluid Acrylics allowed for variation in opacity and structure, providing the closest match to the original, except for the gloss.

An additional layer on the retouched areas to match the gloss was deemed undesirable, as it may increase strain caused by different shrinking and swelling coefficients of the various layers. Moreover, it would complicate reversibility and compatibility, as all products had to remain soluble in different solvents. The main reason to renounce the use of a local varnish is the concept of water vapour permeability. The premixed acrylic emulsion has a long-term water vapour permeability of 84%, which is very close to CN: 81%, creating a nearly tension free film (Hoadly, 2000: 208). Instead, the gloss of the acrylic emulsion paint was enhanced by adding Golden Regular Gel Gloss to the Golden Fluid Acrylics in a percentage varying from 5-20% based on the different inherent gloss level of the colour. This colourless acrylic emulsion is a modifying gel composed of the same acrylic polymer as the Golden Fluid Acrylics, allowing for a stable blend. Close by the retouched areas can be distinguished, while form a distance they become invisible. The final result satisfied both the artist and the curator of the Rijksmuseum (Figure 6).

CONCLUSION

Comparative research showed that Alessandro Mendini’s drawer chest *Nigritella Nigra* was produced in two different series and at least one prototype. Examples from both series show similar degradation patterns on the grease crayon drawings on the top drawer case. The intrinsic instability of the cellulose...
nitrate (CN) varnish layer on top can be considered the main cause for flaking, eventually disrupting the pictorial layer.

The artist interview with Mendini has significantly enriched decision-making preceding treatment. Mendini compares his ziggurat shaped *Nigritella Nigra* as a monument for an artist, with the top-drawer case decorated with handmade drawings, by a young boy with Down syndrome, as the most important feature. Therefore, treatment aimed to rehabilitate the visual appearance such that it would support this idea, improving the aesthetic value of the object.

The degraded CN varnish on the grease crayon drawing could be successfully consolidated with Acrylkleber 498 HV (Lascaux), 50% diluted in demineralised water, and MfK (Lascaux) depending on the capillary action needed. The lacunae were retouched with Golden Fluid Acrylics, adjusted with Golden Regular Gel Gloss.

As a fragile but prestigious object with a meaningful design, Mendini’s *Nigritella Nigra* called for an interdisciplinary approach because of the complex combination of materials and degradation phenomena. Joint input from the artist’s studio, paper conservators, paintings conservators, contemporary art conservators, art historians, and scientists was crucial for a successful conservation treatment.

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Figure 6

Wax crayon drawing on the topside of the top drawer case after treatment.
Photo: Rijksmuseum Amsterdam
ENDNOTES

(1) In the time between submission and publication of this article, Alessandro Mendini passed away. He deceased the 18th of February 2019.

(2) Peter Weiß, personal email to Tirza Mol, 6 February 2017.

(3) This paper is based on the first author’s MA thesis (Mol 2017).


(5) Another version with a pattern similar to Peter Weiß’ object was found in Rotterdam, the Netherlands, in a private collection. In the email correspondence (January 2019) the owners stated it concerns Nr. 1/12 and the top drawer case is in bad condition. At the time of publication there were no photo’s available of this object.

(6) Peter Weiß, personal email to Tirza Mol, 6 February 2017. The fact that we found two different objects numbered ‘5/12’ and ‘1/12’ proves Godani’s statement. Mendini does not know whether all objects have been produced and is only aware of an intended edition of nine and two prototypes (personal interview, see note 3).

(7) As Die Neue Sammlung’s Nigritella Nigra is a prototype, the materials used may differ from the other pieces. Tim Bechthold, personal email to Tirza Mol, November 2016.

(8) Richard Gagnier, personal email to Sanneke Stigter, 7 November 2016.

(9) Dennis Collet, personal email to Tirza Mol, 16 November 2016.

(10) Peter Weiß, personal email to Tirza Mol, 1 March 2017. Weiß’ chest shows similar degradation phenomena on the grease crayon drawings of the top case. Microscopic cross-section analysis of a sample of Weiß’ chest showed the same stratigraphic build-up as the samples of the Rijksmuseum chest. However, py GC/MS analysis indicated that the CN on the drawings differs slightly in composition. This may be indicative of a different batch or brand, and maybe different production dates (Mol 2017: 138-141).

(11) Material analysis was kindly carried out by Henk van Keulen and Suzan de Groot of the Cultural Heritage Agency of the Netherlands (RCE).

(12) For example, the beeswax that painter Brice Marden added to his oil paint was found to have migrated through the interfaces between individual paint layers, causing them to separate. Flaking occurred in reaction to a difference in tension (Wijnberg 2014: 23-24). Other studies indicate that gouache and crayon in adjacent layers in some of Karel Appel’s gouaches failed in adhesion (van Dalen and Beentjes, 2002: 155; van Dalen et al, 2000: 22-27). In historical wax-resin lined paintings disintegration of the wax-resin mixture has been observed, the wax migrating through the painting’s structure, darkening its surface (Boon, Rainford and Pureveen 1994: 14).

(13) Personal interview, see note 3.


(15) Personal interview, see note 3.

(16) Ibid.

(17) Mendini does not remember the type of varnish. Nigritella Nigra was produced by Design Gallery Milano. Although their website is still online, we were unable to get in touch. Mendini explained they are no longer active (personal interview, see note 3).

(18) Personal interview, see note 3.

(19) Ibid.

(20) Ibid.

(21) Hundreds of displaced CN flakes with grease crayon attached to them were found on the object. The smallest that could not be traced back to their original position have been used as samples for testing.

(22) Artificial ageing was performed in a Xenon test chamber for 20 hours at a constant 40 % RH and 50°C, simulating five years under museum conditions, 3200 hours at 200 lux. An Atlas Xenotest Alpha High Energy with a Xenon arc-lamp was used. The air ventilated Xenon arc lamp radiates 105.087 lux and a 320 nm filter simulates daylight entering through glass.

INVESTIGATING THE COLOURFUL WORLD OF ALESSANDRO MENDINI:
PRESERVING NIGRITELLA NIGRA,
A UNIQUE CHEST OF DRAWERS DECORATED
WITH GREASE CRAYON DRAWINGS

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Gamblin® Conservation Colors
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http://www.kremer-pigmente.de.
Golden® Fluid Acrylics (Golden™).
Golden® Regular Gel Gloss (Golden™).
Acrylkleber 303 HV
(Lascaux and Acrylkleber 498 HV (Lascaux).
Medium für Konsolidierung (Lascaux).
Mowilith® DMC 2. Poly(vinyl acetate).
Mowiol® 4-88. Poly(vinyl alcohol).
Sigma-Aldrich: http://www.sigmaaldrich.com
Paraloid® B72. Deffner & Johann:
Sturgeon glue. Fa. Kremer Pigmente:
http://www.kremer-pigmente.de.
QoR® Watercolors.
Golden® http://www.qorcolors.com

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**LECTURE 015**

**CONSERVATION OF THE OPERATOR CONSOLE OF THE OLIVETTI ELEA 9003 COMPUTER (1959) AT THE MUSEO NAZIONALE SCIENZA E TECNOLOGIA LEONARDO DA VINCI OF MILAN**

**SUPPLIERS**

1:100 - Architectural models, mock-ups and rapid prototyping, Milano, http://1a100.it/

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