Experimental methodologies in the conservation of design objects. Case studies from the RECOPLART Project

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Fig. 1 - Some of the objects restored during the Project. Copyright Plart.

The RECOPLART Project has allowed for the study and restoration of 28 objects of the Plart Collection, selected according to four parameters: relevance of historical aspects, design type, condition of the object and type of material used.

The *Restoration and Conservation Plart Project* was financed in 2015 and 2016 thanks to the contributions allocated by the Campania region in support of museums and collections of local provenance and local interest. The project enabled the study and the restoration of 28 objects selected from the collection of the Plart Museum of Naples, Italy, dedicated to the history, chemistry and application fields related to synthetic polymers, with a particular focus on art and design. The work was divided in two phases: the acquisition of data regarding every single object and the finding of active solutions to their conservation problems (1).

THE PERMANENT COLLECTION OF THE PLART MUSEUM

The Plart Museum (Naples, Italy) is dedicated to the history, chemistry and application fields related to synthetic polymers, with a particular focus on art and design. The permanent collection is comprised of a selection of plastics ranging from: mass-production common use objects dating from the second half of the nineteenth Century until today; innovative author designs in eco-sustainable materials; contemporary artworks made of man-made polymers, recycled plastic materials or even reused objects. Different types of synthetic and semi-synthetic materials can be found in the collection: from the early plastics to the ones that changed our everyday life, to the recently conceived bio plastics.

SELECTION OF THE OBJECTS

The objects being studied and restored within the project were selected from the Plart's permanent collection according to four parameters: historical relevance, design, conditions of the object and type of material. Below is a short description of some of the objects (Fig. 1).

- *Cerise*, two boxes (the red one in cellulose triacetate and the black one in phenolic resin) designed by Renè-Jules Lalique for *Editions Fornells* in Paris in 1923 (Inv. 147a; Inv. 147b).
- Doll made of *composition*, a composite material made of sawdust, glue and other organic materials, such as corn-starch, resin and wood flour, probably produced between the 1920s and 1940s (Inv. 942).
- Lamp in white opaque poly-methyl-methacrylate designed by Alexander Rodchenko for the Worker's Club of the Russian pavilion at the *Exposition Des Arts Décoratifs* in Paris in 1925, reproduced in the Sixties by Italian company *Arteluce* (Inv. 298).
- Table lamp in green, orange, yellow, white and transparent poly-methyl-methacrylate, designed by Ugo La Pietra for *Poggi* in 1968 (Inv. 293).
- *Ufo*, a table lamp designed by Ettore Sottsas for *Arredoluce* in 1957, made of white and yellow poly-methyl-methacrylate and metal (Inv. 301).
- Inkwell in composite material *bois durci* produced in France at the end of the nineteenth century (Inv. 500).

- *Phonola 547*, a radio receiver designed by Pier Giacomo Castiglioni and Luigi Caccia Dominioni in 1939 for Italian company *Fimi-Phonola* (Inv. 526).
- A *King Kong* toy in polyethylene produced in 1964 by *Aurora Plastics Corporation* (Inv. 880).
- A Bakelite toy car produced in England by Cowan de Groot in the 1940s (Inv. 951).
- *Personaggio*, a sculpture made of coloured plastic flowers embedded in transparent acrylic resin, designed by Italian artist Enrico Baj in 1965 (Inv. 1001).
- *Tomato Chair* in red fibreglass, designed by Eero Aarnio in 1971 for German company *Adelta* (Inv. 1005).
- *4875*, a chair in polypropylene designed by Carlo Bartoli for *Kartell* in 1970 (Inv. 1006).
- Three cellulose nitrate hair combs, probably produced in France during the 1920s (Inv. 1009 A, B, C).
- A large sized advertising ice cream cone in fibreglass probably produced in Italy during the 1980s (Inv. 1010).

Study of the objects and identification of materials

The first step of the project was the preliminary study of the objects, including:

- a supplementary and more in-depth literature research on historical and stylistic aspects starting from the data contained in the digital catalogue cards compiled in 2009 and based on: specialised books, magazines and websites, and on interviews of collectors and designers;
- analysis of structural and formal features; organoleptic examination of macroscopic properties (colours, odours, superficial features, transparency, shapes, materials, etc.);
- dimensional measurements;
- analysis of functional and conceptual aspects;
- chemical identification of the objects that had not been previously analysed; in addition, new spectra were taken of the objects that were already identified in 2009.
- analysis of the exposition history and conservation history;
- observation of the general conditions and of specific signs of degradation;
- photographs and close-ups;
- condition assessment, mapping of degradation and prioritisation of interventions;
- treatment hypothesis and preliminary restoration projects;
- general recommendations for storage, exposition and handling.

All the data regarding every object involved in the project were collected into conservation reports. All objects were visually examined. The surfaces of smaller objects were also examined using an optical Zeiss Stereomicroscope Discovery.V8 with a 8:1 zoom range, illuminated with a fibre-optic Zeiss CL 1500 ECO cold LED light source and equipped with an interface for digital photography in visible light. Some materials were analysed using the equipment of Plart's scientific laboratory and others were sent to the Department of Chemistry at the University La Sapienza. The infrared spectroscopic study of the micro samples taken from Plart's objects were done using Attenuated Total Reflection (ATR) technique with a Spectra 100 FTIR Perkin Elmer and an Alpha (Bruker) interferometer at a resolution of 4 cm^{-1}, cumulating 100 scans. The assignment of the infrared active peaks was obtained comparing the spectra to the Perkin Elmer database and to literature. Identification was obtained by means of one sample for each object. Smaller objects were identified without the need of sampling.

Fig. 2 - The Conservation Laboratory. Copyright Plart.

The online database resulting from the cataloguing of Plart's collection (carried out in 2009) was consulted to search for previous FTIR spectrums to compare with the new ones in order to look for possible molecular changes.

RESTORATION PROCEDURES

After the historical, technological and material investigations, solutions to degradation processes found on the objects were adopted by means of active conservation treatment, many of which were experimental since they had no precedents on record. Preliminary tests were performed in order to select the best restoration methodologies (2). Restorations were carried out aiming to re-establish the aesthetic and formal unity of the objects. Treatments were evaluated by means of visual examination, with the help of a magnifying lens, close-up photographs and in some cases an optical stereomicroscope, at different angles of incidence of the light source. The project involved the restoration of different types of synthetic polymers, showing different degradations. Some restoration operations carried out on some plastics had no precedents on record, so experimental solutions were adopted. In such cases, only time will tell if the treatments were successful. All treatments were documented in detail in the conservation reports (Fig. 2).

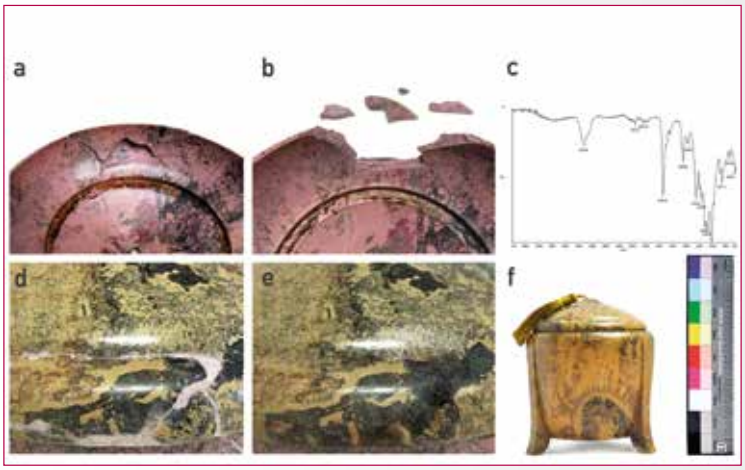

Fig. 3 - (a) The previous reparation (b) Separation of the broken pieces after the mechanical removal of the cyanoacrylate glue (c) FTIR spectrum of ebena (d) After the filling with Balsite (e) After the retouching (f) The jar after restoration. Copyright Plart.

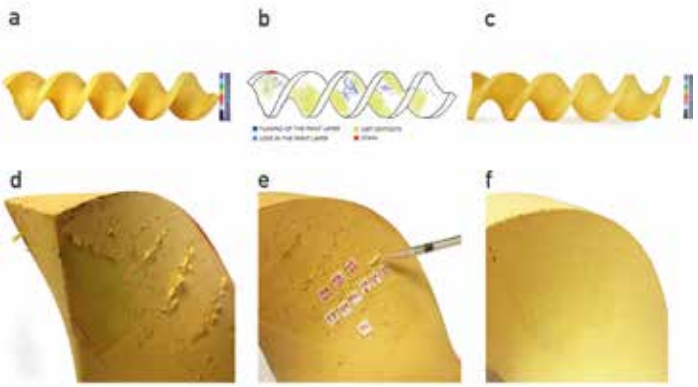

Fig. 4 - (a) Fusillo before restoration (b) Mapping of degradations (c) Fusillo after restoration (d) The degraded paint layer (e) Consolidation tests (f) The paint layer after the retouching. Copyright Plart.

CASE STUDIES

Of the 28 objects of the project, four of them were chosen as case studies for this presentation: a urea resin table lamp from the 1930s, a tobacco jar from the 1920s, a German designer lamp from the 1970s in expanded polystyrene and a prototype of a designer floatation toy in painted polyurethane. Unfortunately, of the four objects, only a Raman spectrum dating 2009 was found, thus not comparable with the new FTIR ones. After the preliminary studies and tests, restoration procedures were undertaken. The following are the conservation reports of the four objects.

CASE STUDY 1

Tobacco humidor box (Inv. 117) produced by *Etablissements Ebena SA* (Belgium) during the 1920s (most probably between 1929 and 1931). It is composed of a container unit and a lid. Three vertical mouldings run vertically along the container unit and form the three supporting feet. The lid has a convex surface and a central hole designed to accommodate a (missing) golden tassel, which was an ornament formed by a bunch of threads bound at one end and hanging free at the other. Ebena is a thermosetting composite material probably made of organic materials such as copal resin, saw dust, pigments, cellulose and minerals. The sample has a spectral behaviour showing peaks attributable to cellulose, lignin and copal. The presence of linseed oil is also possible, possibly used to treat the wood fibres. The material is smooth, compact and light. The interior parts of the box are pink with darker veining, while the exterior parts show a yellowish varnish (based on literature research it could be shellac or nitrocellulose based). A very worn-out inscription is visible on the lower base of the object, possibly attributable to the company's brand name, Ebena. Such trademark is also present on another object of the Collection (CAT. 343). It is kept in Plart's storages since 2008. It was exhibited in Naples (*In Plastica*, Museo Pignatelli, 1990; Plart Permanent Collection, 2008-2009), Sao Paulo (*Plástico, Formas e cores dos materiais sintéticos*, Fundacao Armando Alvares, 2002), Turin (*Plastic Days*, Museo Ettore Fico, 2015).

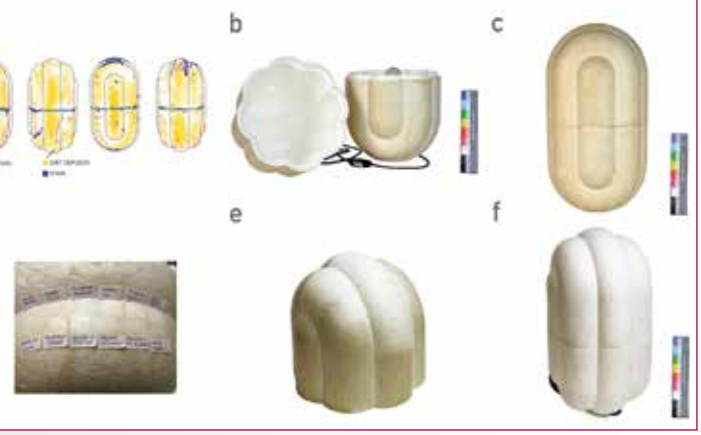

Fig. 5 - (a) Mapping of the conditions (b) Detail of the lamp before cleaning (c) Metropolight before restoration (d) Cleaning tests (e) Detail during the cleaning (f) Metropolight after restoration. Copyright Plart.

Historical information: Information on the production of such peculiar material was obtained thanks to interviews of collectors and research on specialised websites. The company *Etablissements Ebena* was founded in 1921 by Robert Meeùs and Léon Guillon. Ebena produced elegant and trendy objects from copal resin, exported by Belgium from its colonies in Congo. The resin underwent chemical processes and was mixed with other materials such as minerals and tissue paper. The mixture was subjected to the pressure of several tons in moulds generally consisting of two parts. The edges were cut out and the surfaces polished by skilled craftsmen, so each product was guaranteed to be unique (3).

Condition assessment: The object showed fair general conditions. The jar presented a thin layer of dirt. A circular and an oval residue of adhesive on the bottom of the jar were most probably due to old cataloguing labels. Small cracks were present on the internal base of the box and the outer part of the lid. The lid had been broken into two bigger pieces and two smaller ones and then inaccurately repaired with an extremely fast cyanoacrylate based glue. The accidental break also caused material losses in the areas adjacent to the break. Aged deposits of a less adhesive and older glue were also present on the unvarnished interior of the box. The tassel was missing, even though it was shown in a photograph of the same object from the 1990s. Degradation was mainly caused by inappropriate handling in the past.

Preliminary tests: solubility tests on the original materials and on the adhesives, also in the attempt to identify them; identification of the aged adhesives; re-adhesion tests; retouching tests. The glue that was used in the previous reparation of the broken lid was partially soluble in acetone, although such solvent could not be used because of the presence of natural resins. Ligroin, isopropanol and water seemed not to damage the surfaces. A Velvesil plus gel of ligroin and a water in oil emulsion of ligroin were tested to at least soften the glue, without success (cyclomethicone was applied before and after the test, to prepare and then rinse the surface). The other glue residues were soluble in ethanol, which dissolved the yellowish varnish and partially the pink colour. A 15% Klucel G gel in ethanol whitened the varnish. Whitening also occurred with solvents such as butyl acetate. Isopropanol was able to soften such residues without damaging the surfaces.

Restoration: The tobacco jar was dusted with a sable hairbrush and a museum vacuum cleaner and then cleaned with demineralised water applied with a PVA sponge, followed by absorption with a microfiber cloth. The broken and repaired pieces were separated mechanically with the help of a scalpel and a spatula. The glue residues were mechanically removed with a scalpel. The internal glue deposits were softened with isopropanol and mechanically removed with the tip of a bamboo stick. The broken parts of the lid

were re-adhered with synthetic polymer Aquazol 500 (40% in demineralised water), the only adhesive among the tested ones strong enough to hold the pieces together and being reversible in water. Fillings were done with Balsite K+W and then the object was retouched mimetically with pigments applied in Regalrez 1094 (40% in ligroin). Finally, a new tassel was recreated according to the historical pictures (Fig. 3).

CASE STUDY 2

Fusillo (Inv. 678, 200 x 220 x 860 mm) is a prototype art object inspired by a pool floatation toy, called a *noodle*, representing the oversized version of a kind of Pasta, in poly-ether-urethane compact foam probably covered by a synthetic paint, possibly acrylic-based. *Fusillo* was designed by Keith Mascheroni and is part of a collection of pasta-shaped floatation toys, together with the versions representing a *Raviolo* and a *Penna rigata*, manufactured by *Heller Inc.* (USA) in 2006 although never produced (4). The object is made of a spiral-shaped foam block covered by a light yellow monochrome paint. A parting line is visible. It was donated to Plart in 2010 and exhibited in Milan in 2006 (Salone del Mobile) and 2015 (*Campania cibo per l'arte*, EXPO).

Condition assessment: The internal material showed a good state of preservation, whereas the paint layer was in poor condition. The object presented cracking, lifting and flaking of the paint. This resulted in loss of the paint layer, mainly alongside the areas of the spiral that would suffer major mechanical stress when handled incorrectly. The aesthetic unity of the pictorial layer was extremely disturbed by such losses. Also, the object presented loose dirt particles, stains and cat paw prints caused by inappropriate storage and handling conditions of the object when it was still part of a private collection. Pitting was visible in some areas, but it was due to the production process, not to any kind of degradation. No previous restorations were detected.
Preliminary tests: Solubility tests of the paint, solubility tests of the poly-ether-urethane, cleaning, consolidation and retouching tests were carried out in order to plan the restoration procedures. The paint is insoluble in water, whereas it is soluble or partially soluble in solvents such as ethanol, white spirit, acetone, isopropanol, ethyl lactate, ethyl acetate, dowanol, butyl acetate. The least damaging and most effective cleaning agents were Art Sponge, Tylose MH300P gel (15% in demineralised water) and a 2% solution of Tween 20 in demineralised water - although recent research results recommend a limited use of surfactants on young acrylic materials (Ormsby et al 2007).
For the consolidation of the paint layer, different adhesives were tested: Plextol 500, Lascaux D498M, Klucel G, Impranil DLV, Acril 33, Aquazol 500, Tylose MH300P Eva Art, Beva D-8-S. Klucel G was best adapted to the surfaces optical properties and to the light and elastic nature of the paint. As for the aesthetic conservation treatments, the paint layer was quite thin, so it didn't need any filling. Many retouching solutions were tested, such as acrylic paint, Pan Pastel, watercolours, pigments in different adhesives in solutions at various percentages.

Restoration: The areas where the paint layer suffered from flaking were consolidated with Klucel G (10% in water) applied by brush. The bigger flakes were easily adhered with Lascaux HV498 (30% in water) applied by injection, with the help of a small retouching brush and a cold heated spatula protected with silicone rubber. The object was first dry-cleaned with an Art Sponge. For surface cleaning, a Tylose

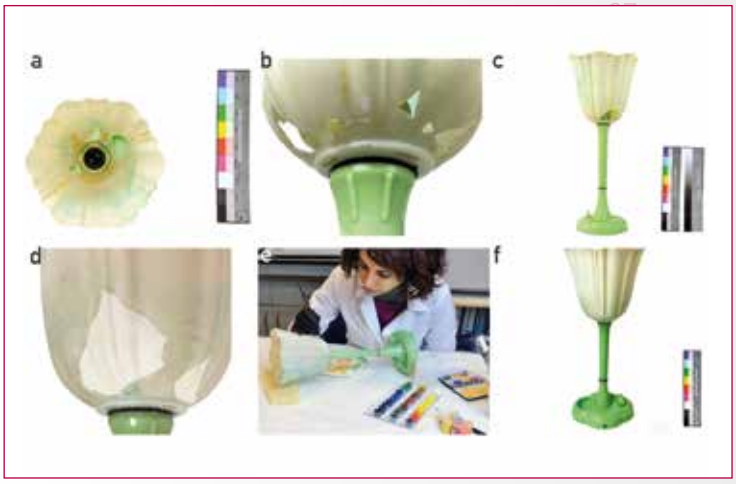

Fig. 6 - (a) Detail of the previous reparation (b) Detail of the losses and the glue residues (c) The lamp before restoration (d) Filling of the losses with Milliput (e) During the retouching (f) The lamp after restoration . Copyright Plart. .

MH300P gel (15% in water) was applied for 2 minutes, removed with a rolling dry cotton bud, rinsed with a small quantity of water applied with a cotton bud and finally dried with a microfiber cloth. In order to treat the paint losses, a layer of Impranil DLV applied by brush was applied to isolate the polyurethane. Retouching was carried out with pigments (titanium white and yellow ochre), mixed with small quantities of Lo-vel used as a matting agent, applied in Aquazol 500 at a 25% dilution in water (Fig. 4).

CASE STUDY 3

Oval monochrome white table lamp *Metropolight* (Inv. 329, 600 x 300 mm, 1.5 cm thick) consisting of two pieces and an internal light bulb, designed by Jan Roth and produced by Design (Germany) in 1971. The lamp is made of *Styropor*, an extremely light and compact material composed of expanded polystyrene balls pressed together. It was donated to Plart in 2009 and was always kept in the storage rooms.
Historical information: The report written within the RECOPLART project on the use of EPS within the artistic field states that in the same years Jean Dubuffet used polystyrene, a light, paintable, cheap and easy to work and assemble with material in search of a different form of expression to the traditional reference system, the designer Jan Roth experimented with the use of EPS in the design of a lamp, the *Metropolight*. The material used by Roth is the Styropor, patented in the Fifties by the German company *Basf* and normally used as building material and for packaging and thermal insulation (5).

Condition assessment: The lamp presented a uniform superficial layer of dirt that obscured the extreme whiteness and the elegance of the design, as well as orange stains caused by the migration of oxides from the metal parts. Small material losses, breaks and deformations were probably caused by accidental impacts with other objects. The internal lamp-holder was oxidised. Due to mechanical stress, the edges of the lamp presented a slight brittleness. A slight thermal degradation was visible on the upper internal part of the lamp, caused by switching on the light. Even though the EPS conditions were good, dirt and oxidation products may attract moisture and catalyse further degradation to the plastic and metal parts. Therefore, a cleaning treatment was necessary.

Preliminary tests: Because of the peculiarity of the material, preliminary tests were especially important. First, so-

lubility tests of sample plain EPS boards were done. Many products were tested and evaluated basing on damages they caused to the surface. Cleaning products previously selected for not damaging EPS were then tested for their effectiveness in cleaning various types of dirt on samples of EPS, artificially dirtied with substances of different chemical nature: generic dust, iron oxide powder, face powder, lipstick, acrylic paint, ballpoint pen ink, candle wax (6). Art Sponge, pulverised Aka Pad sponge, applied by brush and later vacuum cleaned, agar rigid gel and Groom/Stick were effective on loose fine particles. Tween 20 was effective on fatty dirt and superficial dirt. Demineralised water was slightly effective on superficial dirt. TAC was effective on iron oxide. Klucel G gel in demineralised water, Tylose gel and TAC were effective on superficial dirt. Klucel G in ethanol was slightly effective on acrylic paint and ink. The surface's texture and the material are extremely sensitive to solvents, pressure and abrasion. A selection of dry, aqueous and solvent-based cleaning products were finally tested on *Metropolight*. Results were evaluated before, during and one day after cleaning. The following materials were evaluated as damaging if used on EPS: scalpel, boxwood spatula, toothbrush, microfiber cloth, lukewarm water, hot liquid agar and organic solvents.

Restoration: A preliminary dry cleaning was done with Wishab powder Aka Wipe soft applied by brushing, followed by a careful removal of the residues left in the indentations of the rough surface with the help of a synthetic brush and a museum vacuum cleaner. The lamp was cleaned with a 1% demineralised water solution of Tween 20 applied by cotton bud with a very little pressure, by circular movements. Removal of residues of surfactant was done with dry cotton buds applied with a rolling movement, followed by rinsing with a small quantity of demineralised water and dried with a microfiber cloth. A quite homogeneous result was obtained. The orange oxidation stains within the polystyrene were removed by applying a 0,2% water solution of a 1:1 mixture of TAC and sodium citrate tribasic (0,1 + 0,1 %) gel in Klucel G (10% in demineralised water). The gel was left on the surface for one minute, then the residues were removed first by swabbing the surface with dry cotton and then by rinsing with cotton and demineralised water. The application was repeated when necessary. The oxidised metal parts were prepared by means of very light surface treatment with superfine sandpaper and then ethanol, in order to remove the metallic dust. After that, they were cleaned with disodium EDTA (5% in demineralised water), followed by drying with a microfiber cloth. The metal parts were finally protected with Incral 44 applied by brush. As for the small material losses, breaks and inwards deformations, adhesives and filling materials (such as Tylose MH300P, Klucel G, Mowilith, cellulose powder, EPS balls) are currently being tested (Fig. 5).

CASE STUDY 4

Urea-formaldehyde table lamp (Inv. 1003, 400 x 165 x 125 mm) consisting of an oval green base, a green stem and a white flared, upward-facing lampshade with green shades and vertical mouldings. The lampshade is very thin. A semicircular compartment in the base serves as ashtray. The lamp was manufactured by *J.S. Peress LTD* (England) in 1930 ca. It is located in Plart storages since 2008. It was exhibited in Naples in 1990 (*In Plastica*, Museo Pignatelli) and in Sao Paulo in 2002 (*Plástico, Formas e cores dos materiais sintéticos*, Fundacao Armando Alvares). Trademarks: J.S. PERESS LTD, MADE IN GREAT BRITAIN, SS2I.
Historical information: The information about the origin of the lamp is limited to the name of the manufacturing company. No bibliographic research led to the identification of the company, although the collection includes other objects with the same transcription. In the 1920s, materials derived from the condensation of urea with formaldehyde were patented in Austria, Germany and England. Unlike the materials based on phenol-formaldehyde, urea formaldehyde enabled the creation of objects characterised by a much wider range of colours. However, since the cost of moulding was higher than that of materials based on phenol-formaldehyde, this material tended to be used only where the colour was important, such as in telephones, radios, cigarette boxes, lampshades, etc. In the 1930s the production of this material was completely replaced by melamine (7).

Condition assessment: The condition of the lamp was quite bad. The lamp presented dirt and aged residues of an epoxy adhesive used in a previous reparation, occurred between 1992 (year of the exhibition *In plastica*; pictures show that the lamp was not broken yet) and 2008 (year of opening of the Plart Museum). The lampshade was yellowed and brittle, likely because of light exposure, occurring during the lamp's life as a functional object prior to its musealisation and natural ageing. The breaking of the lampshade and the stem was probably caused by an accident due to inappropriate handling, which also resulted in chips and irregular shaped material losses (five in the lampshade and one in the stem). Residues of an aged adhesive tape, which was supposed to hold the pieces together, were visible on the internal and external surfaces of the lampshade.

Preliminary tests: solubility of the ureic resin; identification of the glue used for the previous reparation; solubility of the epoxy adhesive; removal of the epoxy adhesive by heating; re-adhesion tests; filling tests; retouching tests. The material seemed quite resistant to solvents, but the glue deposits were insoluble in most of the tested ones. A very slight dissolution occurred with Dowanol and dimethyl sulfoxide. Being the ureic resin quite brittle, it was decided best not to use solvents. The tested filling materials were extremely difficult to work with, especially on the bigger losses. The only product that showed good workability was the modelling paste Milliput.

Restoration: The surface was cleaned with synthetic saliva applied both with a PVA sponge and cotton buds, followed by a very light rinsing in demineralised water and dried with a microfiber cloth. The aged epoxy adhesive residues were softened with hot air and mechanically removed with the help of a boxwood spatula. The lampshade was re-adhered with Beva D-8-S and the stem, which had to bear the weight of the whole lamp and thus needed a stronger adhesive, was re-adhered with Bindan E1. After the adhesion, an internal reinforcement with Japanese paper (9 g/m$^{2)}$ was done. The Japanese paper was contoured and frayed with tweezers, then adhered with Beva D-8-S. A temporary matrix made of modelling paste was placed internally in order to allow the filling of the material losses in the lampshade. Filling was done using white Milliput paste, followed by retouching with pigments applied in Laropal A81 dissolved in isopropyl alcohol (Fig. 6).

CONCLUSIONS

The RECOPLART Project allowed us to experiment with restoration methodologies on different types of plastic materials, involving various conservation issues. Restoration procedures were carried out aiming for the re-establishment of the objects' aesthetic and formal unity and trying to

respect the concepts of minimal intervention, compatibility, reversibility, and durability. All objects were studied thoroughly prior to their conservation.The success of a restoration treatment is mainly due to a scientific, cautious, interdisciplinary and well-planned approach, especially in the case of new artistic materials.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to the following persons: Maria Pia Incutti (President, Plart Museum, Naples); Stella Nunziante Cesaro (Researcher, SMATCH, ISMN-CNR, Rome); Leonardo Borgioli (Chemist and Scientific manager, C.T.S. Srl.); Francesca Grimaldi (University La Sapienza, Rome); Enrica Cabianca e Francesca Salari (Restorers, Open Care, Milan); Kelley Lowe (Trainee, University College London, Doha); Chiara Santhià, Sara Aveni and Giulia Dilecce (Trainees, University La Venaria Reale, Turin); Christine Lippert (Trainee, HTW, Berlin); Eleonora Vivarelli (Trainee, Accademia di Belle Arti Aldo Galli, Como). A special thanks goes to Herr Koelsch for the precious information provided on *ebena*.

Notes

(1) The identification of materials was done by Stella Nunziante and Antonella Russo, under the scientific direction of Luigi Campanella. The historical research was done by Pina Di Pasqua. The study and the conservation of the objects were carried out by Alice Hansen and Antonella Russo. A few conservation trainees and professional consultants from different fields where also involved. In particular, the four objects presented at the Future Talks Conference were restored with the collaboration of Open Care, Milan.
(2) Full results of the preliminary tests are available upon written request to Plart.
(3) Text extrapolated from an interview to collector Gaston Vermosen in 2015. For the production process, the website www.materialarchiv.ch was consulted.
(4) As stated in an interview made to the designer in 2015.
(5) Extract from the report written by Pina di Pasqua on the use of EPS within the artistic field. Information on production methodologies was kindly provided by INGO MAURER GmbH, new name of the company Design M.
(6) The full description of the substances used to simulate dirt on the EPS samples is available upon written request to Plart.
(7) Text extrapolated from www.plastiquarian.com.

Suppliers list:

Akawipe soft: milled synthetic latex and cross-linked castor oil (DOG AKA, brescianisrl.it)
Artificial saliva: 0,4% water solution of mucine, TAC, sodium citrate tribasic (CTS, ctseurope.com);
Art sponge: vulcanised latex sponge (CTS, ctseurope.com);
Aquazol 500: oxazoline based polymer (ISP, ctseurope.com);
Balsite K + W: bicomponent epoxy stucco (CTS, ctseurope.com);
Beva D-8-S: water dispersion of ethyl vinyl acetate, polyvinyl acetate, polyvinyl alcohol (CTS, ctseurope.com);
Disodium EDTA: ethylenediaminetetraacetic acid, chelating agent (CTS, ctseurope.com);
Bindan E1: ureic resin glue (Bindulin)
EVA ART: water dispersion of ethyl vinyl acetate (CTS, ctseurope.com);
Incral 44: protective acrylic varnish in organic solvents, added with antioxidants (CTS, ctseurope.com);
Klucel G: hydroxypropyl cellulose (Ashland, ctseurope.com);
Laropal A81: urea-aldehyde low molecular weight resin (BASF, ctseurope.com);
Lascaux HV498: water dispersion of methyl methacrylate and butyl acrylate (Lascaux, kremer-pigmente.com)
Lo-vel: micronized silica powder (CTS, ctseurope.com);
Milliput: epoxy resin modelling paste (The Milliput Company, antichitabelsito.it)
Regalrez 1094: low molecular aliphatic resin (Eastman, ctseurope.com);
Tylose MH300P: methyl hydroxyethyl cellulose (Tylose Gmbh, ctseurope.com);
Triammonium citrate: chelating salt (0,2% water solution of a 1:1 mixture of TAC and sodium citrate tribasic) (CTS, ctseurope.com);
Tween 20: non ionic surfactant (CTS, ctseurope.com);

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Abstract

The RECOPLART Project has allowed for the study and restoration of 28 objects of the Plart Collection, selected according to four parameters: relevance of historical aspects, design type, condition of the object and type of material used. Four case studies were selected based on the different materials and degradation signs they presented: a tobacco box, produced by Ebena (Belgium) during the 1920s, in pre-industrial plastic Ebena; Fusillo, prototype of a floatation toy designed by Keith Mascheroni in 2006, in painted poly-ether-urethane; the lamp Metropolight, designed by J. Roth, produced by Design M in 1971, in expanded polystyrene; a table lamp, produced in England in the 1930s, in ureic resin.
The Project involved an initial survey phase including the study of historical and artistic aspects, the identification of materials and the compilation of a conservation report. Secondly, restoration procedures were carried out aiming at re-establishing the aesthetic and formal unity of the objects and attempting to respect the concepts of minimal intervention, compatibility, reversibility, and durability.

Keywords

Ebena; polystyrene; polyetherurethane; urea resin; restoration; design

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