In-depth case study for ARTGARDEN and AGATO: Casket for the crown reliquary of Holy Thorns (by Elke Otten)

Within the ARTGARDEN research, several mixed-media objects were examined as case studies. The case study of the casket for the crown reliquary of Holy Thorns gave rise to in-depth research by each of the partners.

Art historical research has shown that the casket very likely stems from the same period and region as the very valuable crown-reliquary of the Holy Thorns: the Parisian area at the beginning of the 13th century. It was probably custom-made to conserve and eventually transport the crown-reliquary. This profane object merely has a practical function but is mainly of interest for its enamel medallions. The octagonal shaped box is constructed with oak wood, thick brownish leather, held in place with round headed, decorative, copper alloy nails of three different sizes, placed symmetrically. Twenty-five enameled roundels decorate the box, two on each of the eight sides and, nine on the lid of the box, and one more rectangular enamel plaque at the lock of the box. The discs are copper gilt champlevé enamel with engraved and gilded figurines surrounded by a lapis blue background (in different hues). This type of enameled discs, originally from Limoges, were produced in series and commercialized in Europe since the late 12th century.

This coffret can be placed alongside several other (reliquary) coffins from the same period, notably the box of Saint Louis conserved at the Musée du Louvre and the rectangular leather coffret conserved at the Metropolitan Museum of Art.

Apart from the crown-reliquary being mentioned in inventories in the 14th and 15th century, not much is known about the history of the coffret, the precise history since the production of the coffret in the 13th century until the late 19th century remains unclear. In that period, is was exhibited at two exhibitions in 1880 and 1888. (for more information : https://agato.kikirpa.be/text/casket-for-the-crown-reliquary-holy-thorns) Little could be retrieved about the historical storage conditions of the box.

The laboratories of KIK-IRPA identified the constituent materials at but also looked at the damage phenomena present.

MA-XRF made clear that the medieval enamels have a composition comparable to that of the Roman period. The metal support is a gilded copper plate, the gold being applied by ‘amalgam gilding’. The presence of a thin gold layer is less evidenced on some parts of some medallions, probably as a result of wear.

All enamels contain cobalt(oxide) as blue colorant. Calcium antimonate and tin oxide are historically the most used opacifiers. The blue enamels on three of the medallions contain antimony but no tin, these enamels could be dated as early 13th century.

MA-XRF analysis of the decoration band at the border of the box unveils the wrapped thread and the flat lamella are both made of brass. The wrapped thread is made of a metal strip wound in S-direction around a white textile core yarn from flax. MA-XRF analysis indicated a different copper/zinc ratio for the flat lamella and the wrapped thread. This is reflected in a color difference as shown by the Hirox images. The SEM-EDX analysis allowed to study the elemental composition of metal and also shows the presence of corrosion of copper.

The Hirox images clearly indicate the presence of iron nails and brass nail heads, soldered onto iron cores. Lead-tin alloy was used as solder material between the nail heads and the nails. The MA-XRF identified both the nails used to fix the copper plates onto the box and some of the nail(head)s used as circular decoration around the enamel medallions are composed of brass.

High Performance Liquid Chromatography and photo diode array detection system (HPLC-DAD) were used to analyze dye compositions. Fiber identification was carried out with optical microscopy under transmitted or polarizing illumination. The red damask silk textile at the inside of the reliquary box has been dyed with Mexican cochineal (Dactylopius coccus species) and tannin. The dye composition of the red silk yarns used in the fabric of the lining of the reliquary box coincides with a fragment of fabric from the Diocesan Museum where the box is conserved. A part of the latter textile might indeed have been used for the re-lining of the box.at the end of the 19th century

Study of the hair pattern showed evenly distributed hair follicles indicating that the original leather was made from cow or calf skins.

Moreover, damage that can occur in mixed-media objects was also considered specifically because two materials damage each other when they collide and a chemical degradation reaction occurs. Indeed, damage caused by a combination of different materials was found in the coffret. In this specific case, the deterioration of this leather is probably a result of the combined effect of mechanical damage (nails used to fix the leather and thus perforating the leather) and damage by climatological conditions (large climatic variations make the leather shrink and expand causing deformations and cracks). (for more information : https://agato.kikirpa.be/download/ARTGARDEN_reliquarybox_LabsKIKIRPA.pdf)

The University of Antwerp worked further on possible harmful effects of gases from materials contained in an enclosed and sealed space, here the inside of the enclosed box. The results obtained by solid-phase microextraction (SPME) coupled to gas chromatography with mass spectrometry (GC/MS), demonstrate that the inside of the reliquary box has volatile compounds that may damage the materials when the lid is closed.

These compounds can be related to the ageing of wood or the degradation of the organic parts of the box and to biodegradation processes (growing of fungi or other microorganisms). The latter are made possible by the conditions found inside of the reliquary box: lack of light and presence of textile, which favors the condensation increasing the relative humidity. The current conditions inside of the reliquary box are not ideal for the preservation of the materials.

For now, the degradation of the silk lining as a result has been limited. However, to prevent long-term deterioration of the silk fibres, it is advisable to prevent accumulation of harmful gases. It would be recommended to decrease the concentration of those compounds for instance by opening the box periodically for ventilation. (for more information : https://agato.kikirpa.be/download/ARTGARDEN_reliquarybox_LabsUA.pdf)

Apart from the above research of the casket by the multidisciplinary team of ARTGARDEN, the actual exhibition and conservation environment of the casket and the possible consequences for interactions of the different materials were analyzed in situ. Indeed, the casket was also the main case study to build the online decision support tool, according to the concept developed in collaboration with an external researcher, José Luiz Pedersoli Jr. (ICCROM), international expert in risk analysis for heritage collections. (Outline of the online decision support tool : see Annex 1 of the ARTGARDEN final report on https://www.belspo.be/belspo/brain-be/projects/FinalReports/ARTGARDEN_FinRep.pdf)

To put this tool to the test and refine its functionality, it was decided to carry out a risk analysis of the Casket for the crown reliquary of Holy Thorns in situ, in the Musée Diocésain of Namur. The QuiskScan© method (Brokerhof and Bülow 2016), generally used to get a better overview and understanding of the risks to which a collection or subcollection is exposed, was chosen and exceptionally applied to this single object. (for the process of this analysis see Annex 4 of the ARTGARDEN final report)

In close collaboration with the museum, the different steps of the QuiskScan were executed to map the exhibition environment of the object. To obtain a complete overview of the situation, all of the 10 agents of deterioration are taken into account: physical forces, incorrect temperature, incorrect relative humidity, fire, water, biological agents, light (and UV and IR radiation), theft and vandalism, dissociation and pollution.

The characterization of the object is the core of the process, as the different materials each have their own specific vulnerability. In the next step, their relative value is defined in relation to the other materials. Then, all risks are analyzed according to the vulnerability of each material and the possible exposure to any of the 10 agents of deterioration is determined. Together, these two parameters contribute to formulate the risk level. Ultimately, they are combined with all assembled data to understand where the risk of loss of value is the biggest in the collection and how much of the collection would be lost in that case.

The assembling of the data necessary to perform a QuiskScan calls for an important dialogue with the museum. It compiled a 125 questions interview with the conservator and an extensive documentation campaign. The exhibition room of the casket was photographed, and its floorplan was drawn. The room, all fixtures, the exhibition furniture, the technical equipment and location of the collection and subcollection were indicated. In an additional layer, the exposition to risks linked with each agent of deterioration was mapped.

A modest measuring campaign was set up to support and complete the date gathered during the interview. A datalogger registered both temperature and relative humidity inside and outside the display case of the casket. A second datalogger was installed to measure light and UV radiation. Punctual measurements of light and UV-radiation were systematically taken on the occasion of two different visits.

The results of the QuiskScan finally allowed to put former concerns into perspective and focus attention to more pressing issues. Light intensity, for instance, didn't proof to be a major concern. Continual measurement of light- and UV-radiation permitted to better appreciate the effects of a basic mitigation action that was put in place. The data clearly showed that with the textile cover light levels were sufficiently reduced to obtain a safe environment for the casket during the period of the measuring campaign.

The whole analysis pondering all risks against each other, provided a reliable reference to test the functionality of the AGATO tool. The automated analysis should eventually grant its user the same risk ranking and allow guidance when it comes to taking decisions on the preventive conservation of a historic mixed media artefact.

In this case, both the labor-intensive QuiskScan and the automated analysis from AGATO pointed to the main risk of loss of value by a fire, and by wrong relative humidity (Fig. 1).

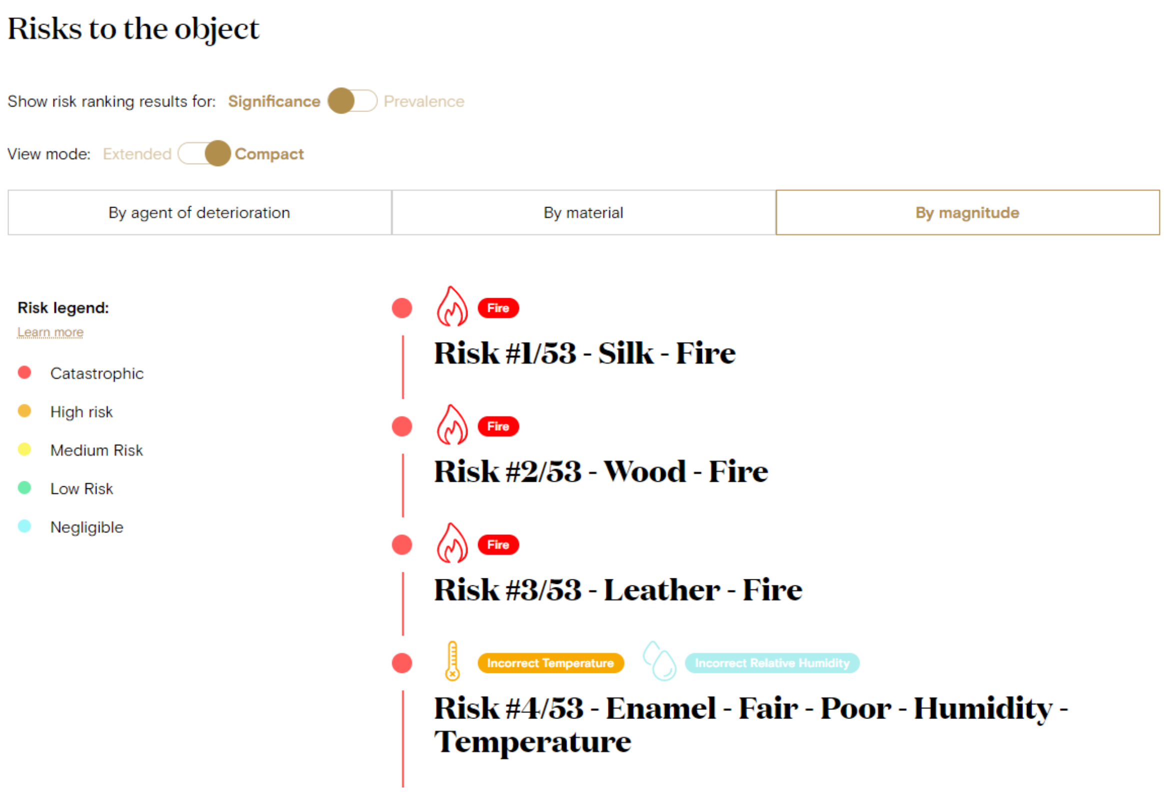

Fig. 1 : Outcome page (risks to the object) for the AGATO test case 'Casket for the crown reliquary of Holy Thorns'

In parallel with working on a user-friendly front-end for AGATO – in collaboration with the external developer Multimedium – an underlying database was also set up. In a first phase, the constituent elements were determined, in a second phase how they should interact with each other to obtain an adequate risk analysis. Extensive discussion was required in setting up this functional skeleton for AGATO to ensure that the right terms were available for each search in the database and also that a correct calculation could be made for the final ranking of the risks (for details on the developer's Risk Selection & Ranking see Annex 2 of the ARTGARDEN final report). In this content management system (CMS), heritage risk analysis terminology and parameters were matched with input fields. (Fig. 2)

Moreover, the CMS meets additional requirements: linking bibliographic references and images to the various elements, keeping an overview of the content that has been added, a structure that makes it possible (in time) to translate the content of the fields and to be able to modify and supplement all content at any time with recent findings. Moreover, the CMS can be completed by different employees (without IT experience).

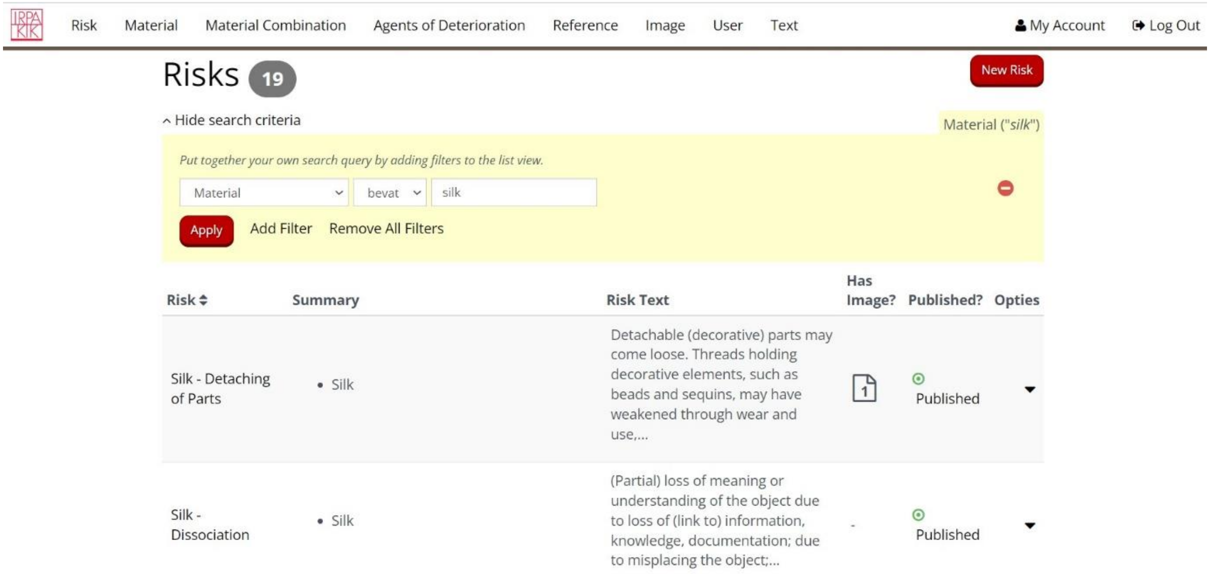

Fig. 2 : Screenshot of the Content Management System (CMS) for AGATO

To make the AGATO prototype work, the necessary content was also entered into the CMS. More specifically, this included the description of 10 agents of deterioration, 18 related questions and 18 materials (present on the Enclosed Gardens and the Casket). For each of these 18 materials, a concise text describes each risk: the potential impact of an effect by an agent. In addition, recommendations are also written out (according to the ‘stages of control’) to avoid damage, block the agent, detect it and react in case damage has occurred, each time with corresponding bibliographic reference. The almost 400 risks and 1600 recommendations described also include the damage patterns specific to the 35 material combinations included in the CMS.