

WHAT DO WE SEE WITH OUR EYES AND WHAT DO WE “SEE” WITH OUR FINGERS?: UNDERSTANDING PAINTINGS WITH A SURFACE RELIEF

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Abstract: Students at the Restoration Department of Academy of Fine Arts and Design, University of Ljubljana, have been producing technological studies of artwork details in collaboration with the Museum of Modern Art in Ljubljana to protect originals, to research how artworks were created, and museum visitors to get acquainted with artworks also by touch. Especially rich surface textures are incredibly difficult to imitate when making handmade copies. Therefore, 3D technologies have become known as a way of producing extremely reliable copies. The research started with a pilot project combining four faculties of the University of Ljubljana (Academy of Fine Arts and Design, Faculty of Natural Sciences and Engineering, Faculty of Arts, Faculty of Education) and the Museum of Modern Art in Ljubljana, and was co-funded by the Slovenian Ministry of Culture and the European Social Fund. Research questions addressed are: where copying artworks with 3D technologies could fully replace handmade copies, do handmade copies even make sense anymore, and which of the two copying options resemble the original artwork better.

Keywords: canvas paintings, surface texture, 3D scanning, 3D printing, handmade copies, conservation-restoration

INTRODUCTION

Conservators-restorers often deal with artworks that need to be moved to safe storage spaces and replaced with specifically made copies due to unsuitable exhibiting environment conditions. Another potential reason for making artwork copies is that people, especially those with impaired vision, wish to touch artworks, which again is not in agreement with accepted preventive conservation practices and does not ensure basic heritage preservation conditions. This is why students at the Restoration Depart-



Fig. 1



Fig. 2

ment of Academy of Fine Arts and Design, University of Ljubljana, have performed technological studies of artwork details in collaboration with the Museum of Modern Art in Ljubljana within various projects. This has enabled students to research how artworks were created, and museum visitors to get acquainted with artworks also by touch, which is especially valuable with those artworks that have rich and interesting surface textures.

The project, where we very successfully combined technological research and preparation of technological studies for visitors to touch, was the project called *Gabrijel Stupica Up Close*.

GABRIJEL STUPICA UP CLOSE

Moderna galerija's Restoration-Conservation Department, in cooperation with other institutions examined, documented, and conserved-restored more than 150 of Stupica's works. Preserving the artist's works required in-depth research of his unique techniques. Cross-section samples of painted surfaces were taken from a number of his works and examined using infrared reflectography and ultraviolet photography. Studies of details from these artworks were then painted by students of restoration at Academy of Fine Arts and Design, University of Ljubljana (Figure 1). This was an attempt to repeat and record (on a video) some of the technical solutions the artist resorted to most frequently, which gave us an insight into his thinking and creative work. We wanted to share our findings with the professional and general public. So we made an exhibition with the video *Gabriel Stupica up Close*, which presented the technology of Stupica's work and ways of preserving his paintings.

The aims of our project were to learn about his technology in greater detail, as this was the first condition for accurately assessing how to intervene in the original artwork when damaged. Some of his paintings were indeed damaged, but many cracks and other kinds of textures that appeared to be a damage had been made intentionally by the artist. Further, we wanted to make such exhibition, which would involve a wide range of visitors, learning about painter's technology through watching the video and touching exhibited technical studies simulating Stupica's work (Figure 2).

To be able to share reliable information, we had to make research and testing that could unfortunately only partly remove the veil of mystery from Stupica's artistic inventions, which he was constantly refining and developing. That's why we were trying to imitate his way of building painting layers by making many different samples of one detail using different techniques and different materials, and by making samples by laying different binding mediums on glass surface to see the pattern of cracks. Gabrijel Stupica was a painter who understood technology extremely well. He knew how different materials behave under different conditions, how they dry, and how to take advantage of the incredible patterns they make. He knew how

to create durable cracks and a layer of paint that appears to be peeling off – and he used all these elements as a medium of expression for his story. To be sure we made it right, a number of samples of paint layers were taken for optical testing. Tests confirmed that Gabrijel Stupica made his paintings slowly, in several layers with not only traditional materials. He used anything that could produce a desired effect.

Besides scientific results, we were also talking to painter's wife, studying his technology, and we produced around 80 technological studies of different Stupica's paintings in different phases of gathering formation. This took one month of intensive work, in cooperation between the Modern Gallery, Ljubljana and Restoration Department at the Academy of Art and Design, University of Ljubljana.

At the beginning we wrote a scenario for the video and prepared the plan for the exhibition. We completely recorded our work on a video. Our goal was "to produce a story" about Stupica as if he would still be among us, painting in front of the camera, to improve the understanding of his work.

Afterwards we made the exhibition, which was divided into two parts:

- The first part presented some original paintings with exposed conservation-restoration problems, visible on photographs of interesting details, where explanations were added and we used certain materials to make our technological studies.
- The second part was the exhibition of 82 students' technological studies and its video presentation (Figure 2). So after watching the video everyone could take students studies in his hands and touch the materials, which made the exhibition especially attractive and accessible also for blind or dim-sighted audience.

The exhibition was open to the public from April to August 2014, and during this period two of our students, who participated in technological workshops, were guides explaining our discoveries to the visitors. At the premises of the exhibition we prepared experts meeting who were discussing results of investigations of Stupica's work. As the summer is the season when tourists are visiting Ljubljana, our exhibition has all texts translated into English.

The exhibition was very well accepted, so Modern Gallery has decided to continue with this and similar projects.

UNDERSTANDING PAINTINGS WITH A SURFACE RELIEF – RESEARCH DESIGN AND RESULTS PRESENTATION

Especially rich surface textures are incredibly difficult to completely recreate when making copies. Therefore 3D technologies (3D scanning and 3D printing) have become producing standard to produce extremely reliable copies of canvas paintings around the world for a while now^{1, 2, 3}. Questions are being raised if and when this way of copying artworks will fully replace handmade copies, whether handmade copies make sense anymore, and which of the two copying options resemble the original artwork more. These are the key questions behind this project. Criteria are credibility of visual image, sensation when touching, production time frame and cost of expenses (materials and equipment).

1 Muck and Križanovski, *3D-tisk*, Ljubljana, 2015, 221.

2 Solly, This New Technique Could Revolutionize the Future of Art Reproduction, *Smithsonian magazine*, 2018. <https://www.smithsonianmag.com/smart-news/new-technique-could-revolutionize-future-art-reproduction-180970988/>

3 Younan and Treadaway, Digital 3D models of heritage artefacts: "Towards a digital dream space", *Digital Applications in Archaeology and Cultural Heritage*, 2015, 240–247.



Fig. 3



Fig. 4

The research started as a pilot project combining four faculties of the University of Ljubljana (Academy of Fine Arts and Design, Faculty of Natural Sciences and Engineering, Faculty of Arts, Faculty of Education) and the Museum of Modern Art in Ljubljana, and was co-funded by the Slovenian Ministry of Culture and the European Social Fund⁴.

Two paintings from the Museum of Modern Art in Ljubljana and a painting from an art student were chosen to have details copied to carry out this project. The two museum paintings were of course not allowed to be touched when gathering results, and the student's painting was allowed to be touched. The selected paintings were as follows:

- **Museum painting** – Gabrijel Stupica, *Girl at the Table with Toys*, around 1967, tempera on canvas, 128×168 cm, signed bottom right: Stupica G., Municipality of Velenje, Gallery Velenje
- **Museum painting** – Gojmir Anton Kos, *Three Women at the Table*, 1938, oil on canvas, 95×78,5 cm, signed and dated top right: G. A. Kos / 1938, Museum of Modern Art, Ljubljana, inv. n. 427/s
- **Student's painting** – Sara Štorgel, *Dance*, 2019, acrylic on canvas, 50×50 cm, owned by author

A detail was selected from each painting, which was copied using 3D printing, and also copied twice by hand – once using the same materials as its original, and once using similar but more durable materials (Figures 3–6).

The following research questions were studied:

- Does the same surface relief, or same colour, or same material contribute most to perceiving an artefact?
- Is a handmade copy more similar to the original than a 3D printed copy?
- What is the difference in perceiving a handmade and a 3D printed copy when visually observing and touching?
- Which of the two copying techniques is more suitable for the target audience?
- Which is more efficient time and money wise (production time, cost of resources)?

3D print copies were made in two different ways, depending on how elaborated the motive was. For paintings with more relief surface structure, an Artec Space Spider laser scanner was used to precisely capture the surface of the paintings. Direct capturing with mentioned 3D scanner was used for *Museum painting* – Gabriel Stupica and *Student's painting* – Sara Štorgel. After capturing (Figure 4), a ZMorph multipurpose printer was used to extrude thermoplastic material in layers and print the relief structure

⁴ Students involved in the project were: Maja Janičijević, Ana Starman, Lara Železnik, Sara Štorgel, Mojca Žižek, David Bogataj, Matic Strgar, Sinja Stres, Ema Zupan, Gaja Vatovec.



Fig. 5

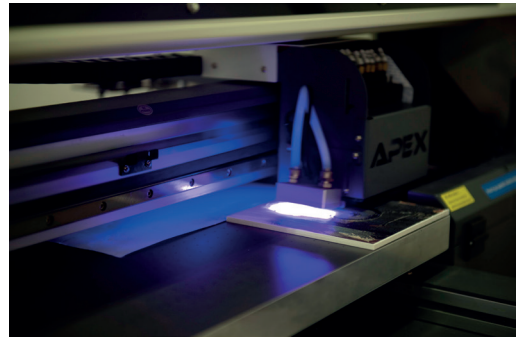


Fig. 6

(Figure 5). The final 3D prints were in white colour. To get the realistic impression of the paintings, the motif was captured with digital camera and then printed with Apex 60x90cm Flatbed Digital Inkjet UV Printer on the relief white 3D printed surface (Figure 6). At paintings with less surface relief and black surfaces (*Museum painting* – Gojmir Anton Kos) the laser scanner did not produce satisfying results, so additional 3D modelling, especially sculpting in Blender, was necessary. After modelling, the same steps as outlined above were applied to produce final 3D printed copy.

When producing handmade copies, it became clear that it is nearly impossible to produce the exact same surface as in the original artworks. The student's painting was created on a pre-grounded, store-bought canvas using acrylic modelling paste, which allowed for relief brushstrokes. Gabrijel Stupica created the surface relief in his painting using a collage technique and a thickly layered ground made of chalk and animal skin glue. The thin paint layers were then applied in egg tempera. Gojmir Anton Kos painted his picture in oil on canvas, in which the relief was achieved by squeezing oil paint directly from the tube, which also meant his painting had the least textured surface. After studying the original paintings and establishing how reliefs were created, handmade copies were made mimicking the materials used originally (Figure 3). For making a copy of a detail selected from Sara Štorgel's painting, an acrylic paste was used on pre-ground, store-bought canvas. For reproducing the chosen detail from Gabrijel Stupica's painting, the canvas was primed and prepared by gluing a fan-shaped piece of a smaller canvas on each copy, one copy then painted in acrylic, and the other in the egg tempera technique. In the case of Gojmir Anton Kos copy, the spiral detail was painted once in oil and another time in acrylic paint (Figure 3).

EVALUATION OF THE RESULTS AND CONCLUSIONS

Experiments with blind and sighted individuals were then carried out at the Museum of Contemporary Art in Ljubljana so that those with normal vision also saw the original paintings and were able to compare the copies to the original paintings (Figures 7, 8). When talking to blind people who touched all three copies of the same detail, it was found that each of the copies demonstrated different information and each could be valuable when presented as part of a story.

In people with normal vision, colours played a crucial role in determining the results. Therefore, if the copies are not held and touched, and 3D printing was produced in correct shades, this technique wins over other copying methods.



Fig. 7



Fig. 8

With this research, it was shown⁵ that new, contemporary 3D technologies produce reliable copies of art and contribute greatly to the field of preserving and promoting cultural heritage. Considering technological equipment is becoming more and more affordable, while there are less and less specialists for traditional painting techniques or complicated contemporary painting procedures, 3D enables quicker and more reliable copying with a lot of added value. This project represents a good baseline for further studies in the areas of improving copy making and working together with blind as well as vision-unimpaired museum visitors.

ILLUSTRATIONS

1: Student preparing technological studies for making video and exhibition Gabriel Stupica up Close.

Студент припрема tehnološke studije za snimanje videa i izlozbe Gabrijel Stupica izbliza.

2: The Exhibition: Gabrijel Stupica up Close, Modern Gallery, Ljubljana.

Изложба: Габријел Ступица изблиза, Модерна галерија, Љубљана.

3: Student preparing handmade copy of Anton Kos' painting

Студент припрема ручно израђену копију слике Антона Коса

4: Process of 3D scanning, capturing

Процес 3Д скенирања, снимање

5: Process of 3D printing, making copies

Процес 3Д штампе, израда копија

6: Printing of image motif on the relief white printed surface with UV printer

Штампање мотива слике на рељефно белој штампаној површини УВ штампачем

7: 3D and handmade copies in front of the original painting in a testing room

3Д и ручно рађене копије испред оригиналне слике у соби за тестирање

8: Tests with blind and sighted individuals

Тестови са слепим и слабовидим особама

5 Janičijević, Starman, Železnik, Štorgel, Žižek, Bogataj, Strgar, Stres, Zupan, Vatovec: "Med izvirkom in kopijo – Kaj vidimo z očmi, kaj "vidimo" s prsti? / Between an original and its copy – What do we see with our eyes, what do we "see" with our fingers?", *Poročilo o delu udeležencev študentskega inovativnega projekta za družbeno korist (ŠIPK) / Report on the work of participants in a students innovative project for social good*, UL ALUO, 2019.

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**ШТА ВИДИМО ОЧИМА И ШТА „ВИДИМО“ ПРСТИМА? –
РАЗМАТРАЊЕ СЛИКА СА ПОВРШИНСКИМ РЕЉЕФОМ**

Резиме: Конзерватори-рестауратори често се баве уметничким делима која треба сместити у безбедне просторе за складиштење и заменити копијама, а све због неприкладних изложбених услова. Други разлог за потенцијално прављење копија уметничких дела је тај што људи, посебно они оштећеног вида, желе да додирују уметничка дела, што се опет не слаже са прихваћеним праксама превентивне конзервације. Због тога студенти Рестаураторског одсека Академије за ликовну уметност и дизајн Универзитета у Љубљани праве технолошке студије детаља уметничких дела у сарадњи са Музејом модерне уметности у Љубљани. Посебно, богате површинске текстуре је невероватно тешко у потпуности рекреирати приликом прављења копија. Због тога су 3Д технологије већ неко време постале познате широм света као начин израде изузетно верних копија слика на платну. Истраживање је покренуто пилот пројектом на коме сарађују четири факултета Универзитета у Љубљани (Академија за ликовну уметност и дизајн, Природно-технички факултет, Факултет уметности, Педагошки факултет) и Музеј модерне уметности у Љубљани, а суфинансирали су га словеначко Министарство културе и Европски социјални фонд. Одабрани су неки детаљи са слика који су репродуковани 3Д штампањем, а такође и ручно. Тада су извршена испитивања слепих и слабовидних особа, тако да су копије могле да упореде са оригиналним сликама. Током разговора са слепим особама које су додиривале 3Д штампу и ручно рађене копије истих детаља, утврђено је да је свака од копија приказивала различите информације и свака би могла бити драгоцене као део приче. Овај пројекат представља одличну основу за наставак студија у областима побољшања израде копија и заједничког рада са слепим и слабовидним посетиоцима музеја.

Кључне речи: слике на платну, текстура површине, 3Д скенирање, 3Д штампа, ручно израђене копије, конзервација-ресторација