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Digitizing cultural heritage: exploiting the gap between standards and individual approach

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Abstract

The digitization of cultural heritage focuses on finding a way to record reality as faithfully as possible and to achieve maximum conformity in the representation of the original object in the digital world. To this end, digitization standards and recommendations have been developed that describe best practices for creating a faithful digital representation, ideally a digital surrogate[1]. However, reality cannot be contained in a single digital file; to better describe it we need to create several, each representing different characteristics of the original object. This brings me to the topic of the paper, I want to focus on the space that lies between the original object and its standardized representation. Therefore, at the National Gallery in Prague we are developing a more complex approach that combines standardization with individual imaging. We focus on capturing different aspects of the work using specific lighting techniques and capture methods. We are trying to document these individual approaches as a complement to the standards, thus enriching the metadata of the object. The aim is to disrupt the concept that a single digital document[2] can replace the original, and to show that complex digitization requires a wide range of documented and repeatable approaches that are applied variably to individual objects.

Motivation

Nowadays digitization approach at the National Gallery in Prague in the imaging department began in 2011. At that time, the digitization process was in the period following a first unsuccessful 7-year phase, during which the institution had failed to make the transition from analogue to digital. Through a step-by-step evolution, efforts were made to set up rules to create a clear and documented process for digitizing the collection of artworks. The aim was to create digital documents that are in general conformity with international standards and guidelines. On the other hand, background in photography highlighted the potential for an individual approach with each subject.

From the beginning, a tension was felt between standardized repetitiveness and a personalized treatment. Both methods possess their indisputable advantages. For a time, attempts were made to combine the two modes into one, to create one digital document that was as close to the standards as possible, but also added something extra. However, it is not possible to combine into one image the capture of the tonal range of a work, undisturbed by its materiality, and at the same time show that materiality is present in the work. Either the focus is on the painting and the colour information, or the focus is on the structure of the canvas and the brushstrokes.

As a result of long-term experimentation and balancing of the different approaches, the most sense is seen in an acknowledged combination of the two approaches, as this is the only way to not deprive the representation of the work of some important aspect.

Figure 1. *Scanner, Flat field light, 2 sources of light*
Figure 2. *Scanner, Direct 45° light, 1 source of light*
Figure 3. *Photography, individual lightning, 1 source of light*
Figure 4. *Photography, individual lightning, 2 sources of light*

It is fully conscious that any digital representation of a work cannot capture all of its qualities, and can never replace the original. However, as digitization becomes a ubiquitous necessity, the perception that digitization can save works, that the content of the work and thus the work itself will be preserved, is beginning to prevail.

Internationally, the term PDO (preservation digital object) has begun to emerge, which meaningfully defines how it seeks to be consistent with the original and in what ways it can replace the original. In the Czech context, unfortunately, the term digital duplicate has started to appear. Whatever is labelled as a duplicate carries with it the idea of the substitutability of the original, and this raises concerns. The best digitization cannot capture all aspects of a work in a single digital document.

It is therefore crucial to address the significant gap between a high-quality, standardized, repeatable digitization that represents the

content carried by the original in the digital world and the original itself. This gap will be explored in the subsequent sections of this contribution.

Problem

If we just confidently follow the recommendations how to create a believable digital file to represent the actual work, we may end up with a situation where all the measured parameters match the assumptions and recommended values, but the work does not look as the viewer might see it in its ideal or idealized form.

In Figures 1 - 4 we see 4 examples of digitizing a 19th century icon. All 4 would meet the conditions for compatibility with the standards and guidelines. Yet we can see significant differences, especially in the rendering of the gold decoration. Figures 1 and 2 were taken on a Cruse CS295ST scanner. The first one is made using the method of balanced illumination of the subject, which is illuminated from the left and right side with equal intensity. The 2nd image is made in a mode where the subject is illuminated by only one light source, which, thanks to specially shaped optical elements positioned in front of the light source, it is able to direct the illumination onto the subject at a 45° angle. By being a line mode of recording, the subject is evenly illuminated even though the light is only coming from one side. Images 3 and 4 are created in a photographic way. Digitized using Fuji GXF100s and flash studio lights in different positions.

In image 1, the relief in the gold decoration is almost invisible. Although the gold is not unpleasantly shiny, it has no shadows because it is illuminated from both sides. This method of digitizing can therefore be described as inappropriate because it fails to represent the spatial qualities of the work. Figure 2 is much more successful in this respect, the volume of the relief is clearly visible. Unfortunately, however, the gold in the saints' halos does not show. It looks dark, just like yellow paint. Figure 3 is very similar to figure 2. The spatiality of the reliefs is convincing, but the halo is still not golden. It is only by adding light, which produces a full-body soft glow in the direction away from the lens, that we achieve the lighting of the halos, and we also find that there is glass or mirror under the carved rosettes that can illuminate them beautifully. On the other hand, this image has somewhat lower contrast in the dark areas of the painting itself.

So it depends on the human element, which must be visually sensitive enough to evaluate these nuances and lean towards some variation. An important role here can also be played by the collaboration with a curator or restorer, who can be a source of important information that will “open” the photographer's eyes before he or she begins to get to know the object through the process of digitisation.

An equally legitimate approach, is to create multiple types of lighting of the subject and store more of them. In this case, however, it is necessary to properly describe what the differences between the images are so that the more appropriate one is clearly chosen in each situation.

Figure 5. *Scanner, restoration works-step 1, Flat field light*
Figure 6. *Scanner, restoration works-step 2, Flat field light*
Figure 7. *Fuji, restoration works-step 2, 45°light*
Figure 8. *Fuji, restoration works-step 2, 35°light*
Figure 9. *Fuji, restoration works-step 2, 35° cross polarized light*

Figure 10. *Painting illuminated with ambient light to enhance the surface*
Figure 11. *Painting illuminated with cross polarization to eliminate inappropriate reflections*

Approach

In 2024, NGP managed to acquire 2 sophisticated digitizing devices, a Cruse CS295ST large format 2D master scanner and a DT Versa including a PhaseOne iXH150 MP and DT Stellar lights.

Both devices enable seamless full compliance with international standards and recommendations (FADGI[4], Metamorphose[5], ISO 19264[6]). However, it became even more apparent that the goal should not be to create only a standardized digital surrogate, but that it is advisable to describe the works in a more comprehensive way, even to combine different approaches and show the differences between them.

A relatively common photographic "trick" is the use of cross-polarization[7] in order to eliminate flare. In many cases this is an indispensable tool, but not infrequently the positive effect is achieved at the cost of a substantial increase in contrast, a significant reduction in the red spectrum, and it is not always desirable that the glitter disappear completely. The negative effects of using cross-polarization can be partially compensated by ICC profiles, the degree of use of the effect, but it is worth acknowledging that it is a major interference with the naturalness of the image. I am not saying that it is inappropriate, but it would be desirable to have this specific procedure documented and there should be a digital document that is taken in natural light so that the cross-polarization effect is visible. This case of polarization and the results from the large format scanner led me to think that it is legitimate to acknowledge that a work looks a certain way in certain neutral conditions, but that this representation may not fully match the "impression" that the viewer normally has of the work. The viewer may subconsciously eliminate inappropriate viewing angles or lighting, and may have a predominantly positive impression of the work that may not be matched by an accurate objective method of recording. Much more likely, he may identify with the variant made by the cross-polarization method. However, for the scientific purposes of both curators and restorers, it is necessary to provide standardized digital documents.

If we now focus on the examples, we can see different ways of rendering the materiality of the captured image. Figure 5 is taken on the Cruse scanner in the light mode of balanced illumination from the left and right sides. The state of the image is after the first stage of restoration, when the image has been cleaned of previous contaminants. Image 6 digitized in the same way, but the image is now after the first varnishing to separate the original painting from subsequent sealants and retouches. It can be seen that the painting looks much less homogeneous, although the human eye is given the impression of a placid surface. For this reason, we proceeded to photographic digitization. Figure 7 is illuminated with two flash lights at a 45° angle, but due to the fresh paint on the dark ground, this angle of illumination of the subject is inappropriate. Figure 8 is lit at 35°, many of the flares have been eliminated, but the image still looks very unsettled. We attached polarizing foils to the same flash lights that illuminate the subject at 35° and used the cross polarization effect in combination with a polarizing filter in front of the lens. The image 9 taken in this way gives a very balanced impression, there are no disturbing reflections, nor do we notice the inhomogeneity of the first layer of paint.

For the purposes of a catalogue or public presentation, the last sample is certainly the most suitable. On the other hand, for the needs of restorers, even figure 7, which gives the worst impression, is useful. For institutional needs, it makes sense to produce both types of digitization.

Similarly, we can notice the difference in the rendering of the image structure in Figures 10 and 11. Figure 10 is illuminated by ambient lighting of the space, with no ambition for quality reproduction. Figure 11 is taken by the cross polarization method. It is obviously more suitable for presentation purposes. However, as in the previous

case, Figure 10 is an important pictorial document because it appropriately shows the structure of the work. For the investigation of the process of degradation of the painting surface, this image is very valuable.

This brings us to the result that several types of digitization may be desired, each of which can represent certain characteristics of the work. However, it is essential that the different approaches are accurately documented and, most importantly, that each image is clearly described in metadata or an image data management application to ensure that they can be used appropriately in different situations.

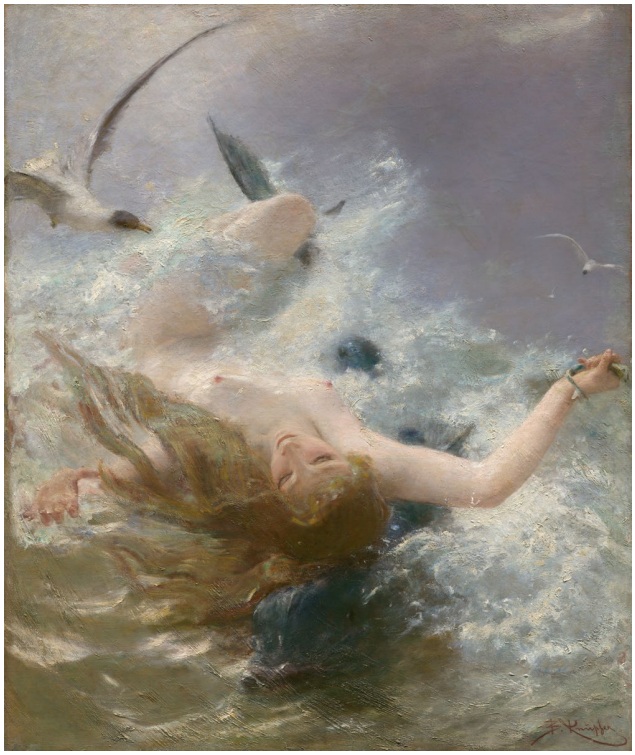

Figure 12. *Entire painting scanned with direct illumination*
Figure 13. *Detail of painting scanned with flat field lightning*
Figure 14. *Detail of painting scanned with direct illumination*

The last example I want to look at is the way the structure of the painting is displayed. Figure 12 is a whole painting that, when studied in detail, is done in a very expressive way, combining areas on the canvas that are very smooth and detailed and areas with a very pasty application of paint. Figure 13 is a cutout of this painting that was digitized under even lighting and we can see that the texture of the painting completely disappears. Figure 14 was digitized using a very directional single light source setup (the line scan method described above still achieved uniform illumination). This detail beautifully captures the dynamism and expressiveness of the painting due to the fact that the structure of the painting is clearly visible. The glosses on the highlights of the painting are not distracting, and the shadows from the pasty paint layers are not too harsh and everything gives a very natural impression.

Of course, both images meet all the prerequisites for compliance with the standards and guidelines. Despite this, there is a big difference in them.

Results

Following of Nietzsche's famous phrase: "There are no facts, only interpretations"[8], which relativizes our idea of a single truth, we can find parallels in the digital world and the visual representation of artworks. We can arrive at the practices that seem most careful, that provide the most faithful picture of reality, but reality is

untouchable in its complexity. We can fight against this and try to devise a method that can capture reality more faithfully and comprehensively, or we can accept this fact and make decisions that will bridge the gap between reality and its digital image.
At NGP, we are still in a state of not having a decision map that defines exactly what type of capture we will use in which case. We have defined a few sub-procedures and leave the rest to individual judgement.
In the case of paintings digitization, we are trying to create the following series of digital documents:
a) a non-framed image conforming to standards in symmetrical lighting
b) if the image has texture, a non-framed image in directional lighting to support the texture of the image and brush strokes
c) a non-framed image in cross-polarization
d) a framed image - ideally in a different type of light than the first frame with an allowable sheen on the painting. The gloss can better describe the physical condition of the work.
e) the reverse side of the work with the frame
We take a similar approach to works on paper, almost always photographing the back of the work even when there is nothing on it. Only if the work is adjusted in such a way that trying to capture it might endanger the work do we not photograph the reverse side.
If we are digitizing graphic albums we consistently take pictures of blank double-page spreads that have nothing on them at all, to show that they exist and are part of the whole.
Digitization at NGP takes place when the collection management system is filled with only mandatory fields, and often we do not get enough of an idea from the textual metadata of what the work might look like or what it consists of. This was one of the other impetuses for this decision to take even seemingly useless images of blank pages. This illustrates how photography is an important and equal type of metadata as text. For the description of the work in the collection system, we do not have a record of whether the painting is framed or not, so it must be apparent from the photograph.
Because we are trying to include other characteristics of the work in the digital representation of the work, it is very important that we work with curators and conservators during the digitization process so that together we can identify what information to populate the photograph with.
However, we are still in the process of preparing model cases to offer to colleagues. Similarly, we do not yet have a realistic scenario for writing metadata describing under what conditions the photograph was taken and what specific characteristics of the work it depicts.

Conclusions

The goal of this paper is to disrupt as much as possible the idea that one work equals one digital document, which could also replace the original. A work will be recorded several times over the course of its life in an institution, for restoration works, loans, condition reports, specialized scanning, etc., so we have to expect that a number of images will be taken and we have to have a system for describing them, we have to have clearly defined types of scanning and how to use the data, so that we don't end up publishing an X-ray of the back of the painting instead of the 'right' one for the general public. The role of metadata and description of the work is as important as the way it is captured and the richness of existing approaches.
My dream for relevant works is to have a standardized digital document of the front of the work, another similar image in cross-polarization, another with a distinctive surface, a view of the work in its adjustment, the back of the work, or even a view into the exhibition where the work hangs on the wall. Each of these images will bring us different values. If we have each type of capture properly documented and described in the metadata, we can successfully expand the amount of information we gather.
The goal is not to create one perfect method of reproduction, but to accept the fact that there is no such method, but there are a range of approaches to choose from, which could be use differently in different situations. And the standardization is that all the procedures are documented, described and repeatable.
What do we need to do that? Find the right metadata fields that describe the conditions for digitizing the works. Find a place to record under what angle we illuminated the artwork, what light source we used, whether we used a polarizing filter, whether the work is intentionally glossy in the image.
We still have a lot of work to do, but at the same time we can be happy that we know where we are going.

References

[1] https://dictionary.archivists.org/entry/digital-surrogate.html
[2] https://dictionary.archivists.org/entry/digital-document.html budu používat tento termín jako obecně digitální soubor, který zobrazuje původní dílo. Nebudu brát v potaz zda se snaží být jeho duplikátem či nikoliv.
[3] Doug Peterson, Kenzie Klaeser, Ben Cort, DT Digitization Guide, Planning a Digitization Program (Digital Transitions, 2024) pg. 61.
[4] Technical Guidelines for Digitizing Cultural Heritage Materials Third Edition (The Federal Agency Digital Guideline Initiative, 2023)
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[8] Friedrich Nietzsche: *Nachgelassene Fragmente* (Posthumous Fragments)

Author Biography

David Stecker is head of the imaging department at the National Gallery in Prague, where he plans digitization projects and strategies. With degrees (BA, MA) from FAMU, Department of Photography where now teach in the studio of classical photography.