LICHTBILD
KULTURSCHATZ
HISTORISCHE
PHOTOGRAPHIE

ARGENTO VIVO
FOTOGRAFIA
PATRIMONIO
CULTURALE

Photography and Digital Long-Term Archiving

Handout 5

Supplement of the Interreg project "Lichtbild/Argento vivo. Cultural Treasure Photography"

Archivio fotografico del Tirolo · Tirol Archiv Photographie

Stadtgemeinde Bruneck
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AUTONOME PROVINZ BOZEN SÜDTIROL
PROVINCIA AUTONOMA DI BOLZANO ALTO ADIGE
PROVINZIA AUTONOMA DE BULSAN SÜDTIROL

The Interreg project "Lichtbild/Argento vivo. Cultural Treasure Photography" is a collaboration between the following partners: the Tyrolean Archive of Photographic Documentation and Art (TAP), the Municipality of Brunico as well as the Office for Film and Media and the Department of Museums of the Autonomous Province of Bolzano – South Tyrol.
The Lichtbild team consists of the following members: Martin Kofler, Rosemarie Bachmann, Helene Ladstätter and Evelyn Müller (TAP), Sonja Hartner and Julia Knapp (Municipality of Brunico), Arpad Langer, Oscar La Rosa and Notburga Siller (Office for Film and Media) as well as Gertrud Gasser and Verena Malfertheiner (Department of Museums).
The team is supported by several representatives of the associated partners: Alessandro Campaner of the South Tyrolean Provincial Archives, Roland Sila and Claudia Sporer-Heis of the Tyrolean State Museums and Bernhard Mertelseder of the Tiroler Bildungsforum in Innsbruck. Another associated partner is the European Region of Tyrol–South Tyrol–Trentino.
In line with the motto "Professional handling, open access. Photography goes future," the project defines guidelines for the competent handling of historical photographs in the project area of Tyrol and South Tyrol. These guidelines are developed within the framework of various workshops; the results will be presented on a webpage, in an app and as an e-learning program. Furthermore, for the first time ever, the project will make historical photos available in Tyrol and South Tyrol as open data.

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Rosa Sigwart with a child, around 1930
(Photographer: Maria Egger; collection of the Municipality of Lienz, archive of Bruck Castle Museum – TAP)

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Wolfgang Meighörner

Photography and Digital Long-Term Archiving

Foreword

For me, the approach that most convinced the Tyrol Provincial Museums to participate in the Interreg program was its focus on the exchange of expertise within the circle of colleagues north and south of the Brenner. I think this is the basis on which to develop this extremely exciting field, which we deal with on a daily basis, and, if we are honest, we are not always knowledgeable about in every detail. I'm referring to the increasing use of electronic data processing in its many facets. When making investment decisions, I routinely deal with IT specialists who, with great conviction, reel off their jargon using what I find to be incomprehensible combinations of letters and numbers and then sometimes look slightly lost when I ask them what they actually mean. I believe we need to think about how to achieve a general, subject-specific standardization that we can all understand.

We are all aware that digital storage media and the devices that read them will not last forever. Who still has 5¼" floppy disks complete with a corresponding drive? And do they still work? This reminds me of a story about a dear colleague of mine, the former Director of the Cologne City Museum, Werner Schaefke. Back in the 1980s, he was already collecting computers, or what was then called a computer. One day, he got a visit from a high-profile delegation of one of the manufacturers, who offered to restore his entire collection – for free. The fact was that the company had important data and media storage, but no longer owned any suitable devices to read them; but Schaefke did.

Many may remember the gold-colored CD disks advertised as "Archive CDs," which, according to the manufacturer, would last indefinitely, whereby "indefinitely" was reduced to ten years when a more precise inquiry was made. This perfectly matches the retention period required by businesses today, of course. But it does not coincide with our retention periods. If we, at the Tyrol Provincial Museums, had to throw away everything that is over ten years old, then there would have been no need to build a collection and research center. So what do we need to do? We need to ensure that our important materials are safely stored, on media that have a long life, and that we also have the corresponding reader devices available on the long term. Because for me personally, as a historian, it is of little use to have infinite binary numbers on a data storage medium if I can no longer read them. In that case I would definitely prefer a nice parchment document. We also need to focus on materials that do not incur spiraling costs and therefore ensure that the Director can stay within the annual budget. When I started working for the Provincial Museums, we considered 3 terabytes to be an enormous amount of data. We need to add a few zeros to bring us up to where we are today – and that was only twelve years ago!

Of course, we also know that the number of digital photos produced per day is increasing exponentially. Nobody knows exactly how many, and maybe that's a good thing, but it is several billion per day. Only a fraction of these data (and I am tempted to say, thankfully!) will probably survive. But they fill our working memory, they need to be processed and then, at the end of the day, they create enormous volumes of work for researchers. So what can we do? Let's compare these data with a document from the 14th century. Handling medieval sources is easy: We collect them, we do not give them away, we preserve them because very few are still in existence. Everything that is rare has a relatively good chance of survival. But our relationship with objects changes when their number grows disproportionately, which is why we must have the courage to clearly and strictly sort through the inventory. This means discarding, not storing. This, in turn, forces us to make a decision about what should last and what should not. And that's exactly what we are trained do to. And when I look around in museums, it becomes apparent to me time and time again that this courage is lacking. However, we must be committed to carefully selecting from this flood of data what we (and by that I mean society!) really need. And that requires expertise, and perhaps also the courage to make clear-cut decisions.

And at the end of the day comes the question of what to do with all this digital material, with all its legal implications and extremely wide range of possibilities for exploitation. On the one hand, from a strictly conservative point of view, it would be better to not put out anything at all. On the other hand, there are those who want to make everything available to the public. Probably both extremes are equally wrong. But no longer do only science or museums lead the way; we have a general public that has its own requirements. And it is that same general public which ultimately pays us for our work.

The author

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Stefan Rohde-Enslin

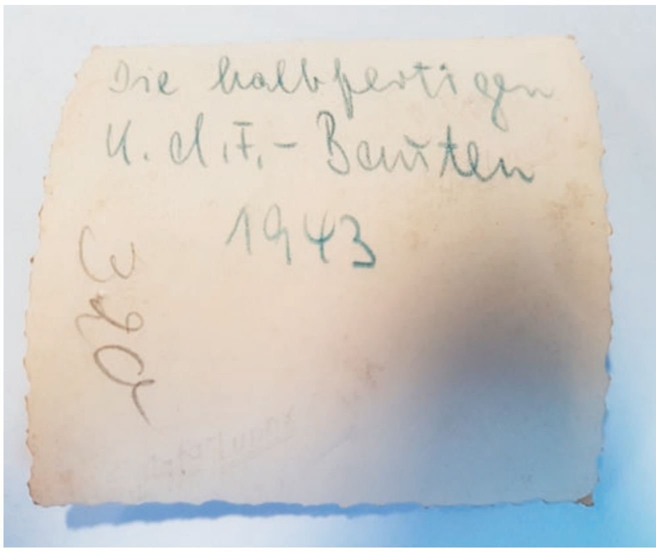
Digital Long-Term Archiving of Photographs

At first sight, the digital long-term archiving of photographs appears to be a simple undertaking: All you need to do is digitize photographs and store them as image files. A more in-depth examination, however, reveals that the process of long-term archiving of digital (or digitized) photographs requires multiple decisions to be made. The following contribution lists some of these decisions and seeks, where possible, to provide support in making them.
The process begins with digitization and ends with archiving. It is important to take archiving into consideration right from the start, during the digitizing process.

What to digitize for the long-term archive

The fundamental question is what exactly to digitize for the archive (or for other uses). Do you really want to digitize your entire photo archive? If several prints of a negative are available in different sizes and qualities, should all copies as well as the negative be digitized for long-term archiving? Each institution must decide for itself. If there are two prints of a negative, each of which have different individual stories, then of course both prints should be digitized, even though they seemingly depict the same image. There will perhaps be

Left: A photograph found by accident – should it be preserved or not?
(Stefan Rohde-Enslin collection, CC0)



Right: Writing on the back providing information about the image
(Creation: Stefan Rohde-Enslin, CC0)

photographs that may not be worth digitizing! If a photographer pressed the shutter for too long and created five or more shots of the same subject, would it not be sufficient to scan just one of the five photographs for the digital long-term archive? Other photographs may not be worth archiving because they are blurred, already faded, or because only half is preserved… or because they are otherwise unsatisfactory from a technical point of view or in terms of content. Should photographs with unsettled rights, or those which, for any other reason, can probably never be shown in public, be transferred into the digital archive? Should prints that you are sure have been digitized by another institution and transferred into an archive also be included in your own archive?

A long-term archive incurs permanent costs. The decision about what is to be archived determines the number of files and the amount of administrative work to be done and therefore, ultimately, the costs. There are two other important decisions regarding the question of what should be transferred into an archive.

If the photograph to be digitized is a print, valuable information is often noted on the back of the picture. Basically, a decision must be taken as to whether the backs of the images – in reduced resolution, if necessary – are also digitized and transferred, which may lead to double the amount of data being archived. It is possible that the writing on the backs was done by different people, and recognizing different people's handwriting allows conclusions to be drawn about the history of the subject of this photograph. Simply retyping what is written on the backs of photographs would be tantamount to losing information.

A second important decision to be taken must start with the purpose of archiving. Many historic photographs bear evidence of their history: cracks and fissures in

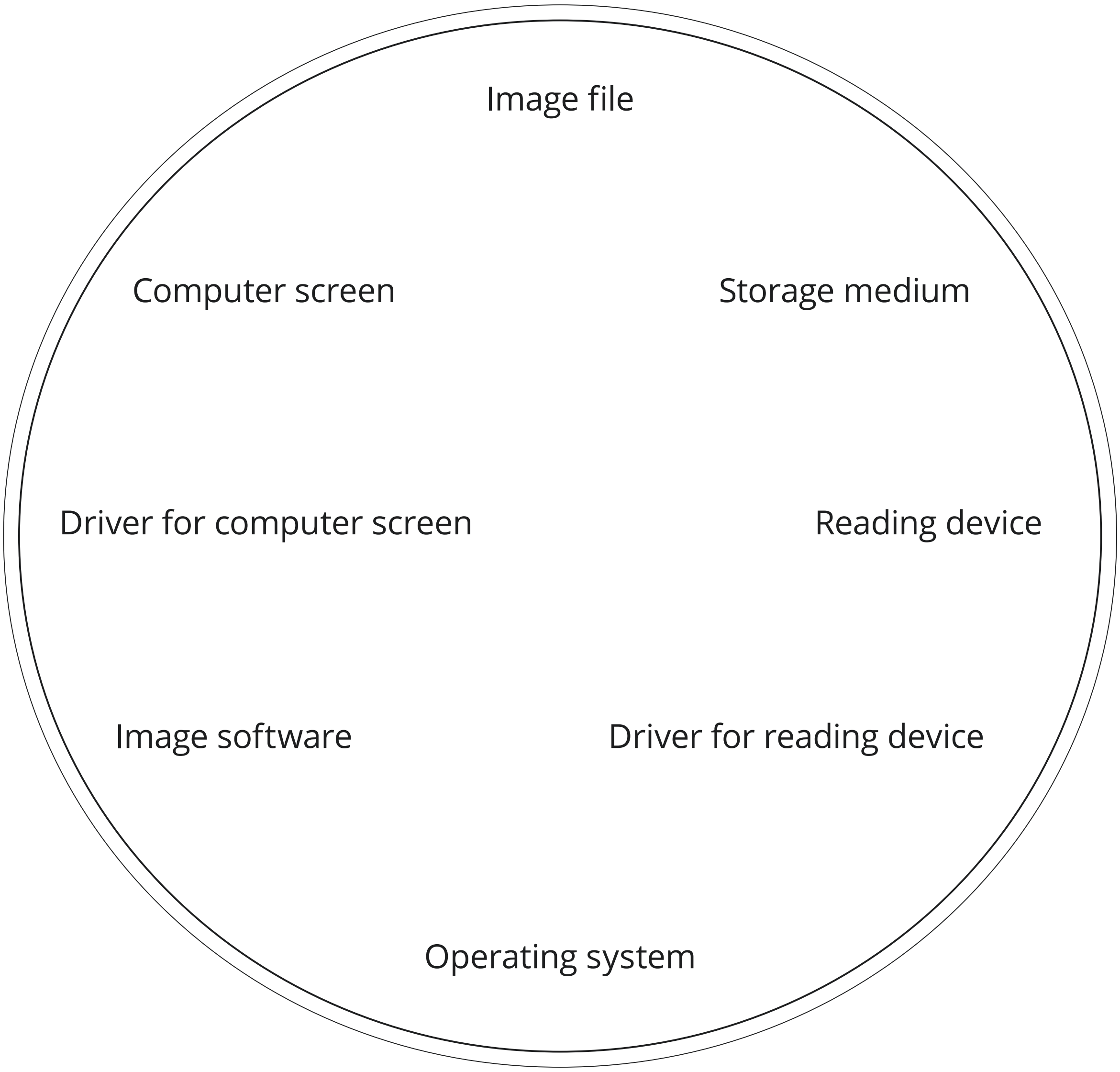
True-to-original scan of the found photograph, therefore "preservation master": always preserve
(Creation: Stefan Rohde-Enslin, CC0)

Corrected version (by hand), therefore "production master": preserve only if necessary
(Creation: Stefan Rohde-Enslin, CC0)

glass plates, scratches on negatives, marks left on prints by water damage, creases, fading, discoloration... After creating a digital copy, the digital image can be manipulated in different ways to remove many of these defects. Which version of the digital equivalent should now go into the archive? The version that most closely resembles the original at the time of scanning and which possibly contains many defects, or the version that represents the picture as it may (or may not) have originally existed? Usually, a distinction is made here between a "preservation master" and a "production master." Almost all institutions archive the preservation master, though many also archive any production masters that may be available. Anyone planning to archive both versions must bear in mind that this will multiply the amount of data in the archive.

Digitizing for long-term archiving: choosing the right quality

Images, like words, carry information. Of course, when digitizing for long-term archiving, the objective must be to keep the loss of image information during media conversion to a minimum. Generally speaking, only a high-resolution scan is worth



An entire system is necessary to produce a visible picture from zeros and ones!
(Creation: Stefan Rohde-Enslin, CC0)

archiving. But the definition of "high resolution" changes over time and with the technology currently available. "High-resolution" scanning may require a great deal of time and expensive equipment. At this point, the decision should be to achieve "as high a resolution as possible under the given circumstances." A general guideline could be the use of photographs in print media, i.e. an absolute minimum of 300 dpi for large-size paper prints in original 1:1 format. The smaller the photograph, the higher the minimum resolution should be (when scanned in the original 1:1 format). Image files with resolutions below a self-set minimum should be considered unworthy of archiving. There should be no upper limit to the resolution values – although we must indeed be allowed to question whether scanning the back of a carte-de-visite (coarse-grained paper with coarsely printed graphics) does not include all information at just 600 dpi.

Digitizing for ong-term archiving: choosing the right format

Deciding which file format to use is even more important than selecting the minimum resolution (depending on size). Basically, every file consists of a series of zeros and ones. A combination such as "11001100" could be a letter, a sound, a control command, in short: anything. However, if this combination is located in a specific position in a TIFF file, then the TIFF format determines its meaning. Preserving a combination of zeros and ones makes no sense if there is no guarantee that the code can be interpreted. Rendering an image file visible again requires programs that are compatible with the selected image file formats, because a plain text program can only open images under certain conditions. The purpose of long-term archiving is to store photographs for long periods of time, and of course no one can be certain that suitable programs for the respective image files will even still exist in 100 years' time. Perhaps in a few years all the files in the archive will have to be converted into another format, as it is foreseeable that there will soon no longer be any programs available to read them. By following a few principles, the risk that files will no longer be readable can, however, be minimized.

The image files in the archive should be saved in as few different formats as possible; this makes it possible to carry out any necessary format conversion automatically. A widely used format should be chosen, increasing the likelihood that appropriate programs will be available. The chosen format should be disclosed; making the format definition freely available means that, if necessary, processing programs required to visualize and edit the images can be written. The format should work without compression, which runs the risk of data being lost. Unlike in other areas of digital long-term archiving, in which the format issue has still not been solved because there are too many formats competing with each other, there really is only one recommendation for archiving image files worldwide: the TIFF 6.0 Baseline Standard (the suffix "baseline standard" means that no compression should be made and that multiple images cannot be stored in one file, both of which are normally permitted by the TIFF format). Basically, TIFF 6.0 should be chosen as the format for all long-term archive image files.

Digitizing for the long-term archive: metadata

Like many other file formats, the TIFF format can include more than purely visual data. Information concerning the image depicted, for instance, can be stored in the so-called file header, alongside technical data concerning the actual file. Needless to say, information about the time the original photograph was taken and its content are essential to understanding the image. Such data can be recorded both in the header of the corresponding image files (IPTC data), through which they are directly linked to the files, as well as in a database (which facilitates a search covering multiple files). Finally, such data for each individual image can also be recorded in a small text file ("txt" or "rdf") and stored together with the respective image in the same folder. Here, decisions must be made as to which information is recorded, in which form and where it is stored. Steps must be taken to ensure that the position of an image within a series of images, on a negative strip or in a photo album, is also saved for later research work. By creating a folder for each image containing additional information in a text file as well as image information in an image file, you lay the foundations for the creation of an "Archival Information Package" based on the OAIS reference model.

Media not suitable for digital long-term archiving: external hard drives, USB flash drives, CDs, SD and CF cards

(Photo: Office for Film and Media, Bolzano, CC BY 4.0)

Digital archiving: where and on what device

Just as image files require appropriate software for them to become visible pictures, storage media require a reading device that must be able to be computer-controlled, as it is also necessary for relevant programs to be accessed through a computer. All components must dovetail with each other, from the computer hardware, operating systems and programs right through to the storage media and reading devices. Asking which storage medium is best serves no purpose; after all, what is the use of having all the data stored on a medium if you are not able to read it because no suitable reading device is available? From 8″ floppy disks, 5¼″ floppy disks, CD-ROMs and DVDs to magnetic tapes, hard disks and solid-state disks… The market is moving fast, and every change challenges the system of interlinked components.

Digital long-term archiving requires a different approach than “classic” archiving. Simply putting the content to be preserved on a storage medium and storing it on a shelf cannot work. On the contrary, continuous care and attention is imperative.

We need to realize in advance when a storage medium is at risk of disappearing from the market. The digitized reproductions must then be copied from the soon-to-be outdated medium to a newer type. Of course, storage media should be chosen that do not need to be replaced within a short time due to defects; it is even more

Digital network storage devices: NAS system (Network Attached Storage)
(Photo: Office for Film and Media, Bolzano, CC BY 4.0)

important, however, to opt for media capable of copying files mostly automatically. If image files were stored on multiple individual CDs or DVDs, the storage medium will have to be replaced many times in order to copy the entire archive.
Either way, a limited shelf life is to be presumed and checks need to be carried out at regular intervals to make sure that the files are still readable. CDs and DVDs should be checked at the least every three years, hard drives every five to seven years. Given the current state of the art, it is probably better to transfer long-term archiving to externally managed servers.
However, if archive data are outsourced, it is extremely important to ensure that the commissioned institution is expected to continue existing for a long time. A contract must be drawn up with this institution, not least for legal reasons, stipulating precisely what can be made accessible to whom, under what conditions and by what means.
Even if the archive is transferred to an external body, long-term archiving remains an ongoing responsibility that requires constant vigilance and control; (an external body must also be checked regularly). This means that within one's own institution it is necessary to define responsibilities, document decisions and drawn up plans that specify exactly which checks are to be made and at which intervals.

Key points

What to preserve and how?

- Front and back? *Recommendation:* Front and back, but the back in reduced scanning quality, if necessary.
- Preservation master and production master? *Recommendation:* preservation mas-

ter always, production master if necessary.
- Define scan qualities according to size of original!
- Metadata: Define which information should be provided about the images, as well as where and how this information should be stored.

Preserve on which device?
- In a "living" system in which storage media and potentially also the selected format change over time.

It is therefore essential to:
- document all decisions and review them in intervals;
- set intervals (i.e. how often checks need to be made);
- define responsibilities (i.e. who checks if files are readable and accessible).

Conclusion

From today's perspective, it is impossible to predict the future costs of long-term archiving. They will, however, be considerable, particularly because an archive of this type becomes redundant, meaning the storage process will need to be repeated several times! Especially in light of the high technical costs and the need to constantly monitor the storage media market as well as the development of file formats and suitable software, small institutions should endeavor to find trustworthy partners for their long-term archiving needs.

The author

Dr. Stefan Rohde-Enslin was born in 1960 in Göttingen, Germany; he studied Political Sciences of South-East Asia and Ethnology at the University of Heidelberg with a doctorate in 1994 on topics regarding the history of science; he completed several historical photo projects at the photo archive of the Rautenstrauch-Joest Museum in Cologne; since 2004 he has been a representative for museums at "nestor" (www.langzeitarchivierung.de) at the Institute for Museum Research of the Staatlichen Museen zu Berlin; within "nestor" he is head of the "Long-term Archiving of Audio-Visual Media" working group; in addition, he is the developer of www.museum-digital.de, a cooperative platform that publishes information about museum objects on the Internet.

Michel Pfeiffer

Digital Image Data

How to define and measure image quality

With the demise of the analog film industry and the subsequent swansong of microfilming, attention turned to digital long-term archiving. And that's a good thing, because it means we have to do more than raise the fundamental question of how digital data are archived in the long term. First of all, we need to clarify what requirements digitized image data need to meet in order to make them worthy of long-term archiving in the first place! In regard to the propagation of the International Image Interoperability Framework (IIIF), which makes it possible to compare individual image data across platforms, the specific urgency of this issue can no longer be ignored.

This contribution examines the issue of how to define image data quality on the basis of a principle that seems to be gaining consensus: that content that is to be digitally stored for the coming centuries should fulfill clear and well-documented criteria. Otherwise it will be difficult to justify the high recurring costs of digital long-term archiving or the transmission of content. It is also agreed that data resulting from digitization should be reproduced as accurately as possible, that is, it should be transferred from one medium to another (transmediality) with as little deviation from the original as possible in order to ensure that its later use is as diverse and unlimited as possible. In this context, we must also consider that photographs are physically subject to decomposition. The degradation processes can only be slowed down by storing them in optimum conditions, but it cannot be stopped entirely.

Quality standards in the digitization process seek to minimize differences with respect to the original to the greatest possible extent. What survives, it is generally hoped, will be digital forms of representation.

Efforts to standardize

Over the past decade, several quality assurance standards for image data have been developed. In this regard, the FADGI standard in the US is worth mentioning. Introduced in 2004, these guidelines have been an integral part of the American quality debate in cultural institutions since 2007.

A four-star system describes various tolerances that must be adhered to when digitizing images, depending on the material. The current version encompasses both transparent light media (negatives and slides) and reflected light media (photographs, graphics, paintings, etc.).

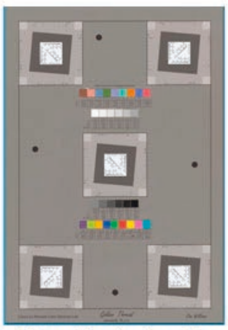
Metamorfoze is a guideline developed by Hans van Dormolen for the Dutch Rijksmuseum, designed to ensure that especially differences in color are minimized during the process of digitally reproducing paintings. Recently, the ISO standard TS 192641 was also introduced. The first part of this standard, which was adopted in 2017, describes criteria for digitizing reflective photographic materials. The second part, as yet unpublished, will deal with transparent media.

TARGET VALUE (original) **ACTUAL VALUE** (data set)

Figure 1: Comparison of target and actual values: left – original ColorChecker SG, right – file measurement values in Photoshop
(Creation: Michel Pfeiffer – CC BY 4.0)

At the root of all these standardization efforts is the desire to establish acceptable measuring criteria that will enable us to assess the quality of a digital copy. The individual standards differ in their methods of measuring these criteria using which tools, as well as in their respective ways of interpreting the tolerances within which a quality criterion is still considered acceptable.
An intrinsic aspect of all standardization efforts is the principle of comparing set and actual values. Depending on the standard, between five and 13 (sometimes even more) different optomechanical and digital criteria are compared. Specific measuring fields known as targets are used for this purpose (Figure 2).
Imprinted surfaces and target samples provide the set values. The targets differ depending on the standard; not every target can be used to measure all the criteria stipulated by every standard. Therefore, it is useful to decide on one standard and then work with the corresponding set of targets.
Metamorfoze provides a very good description of the fields of application and use of targets (see Metamorfoze, p. 29, Bibliography and Useful Links).

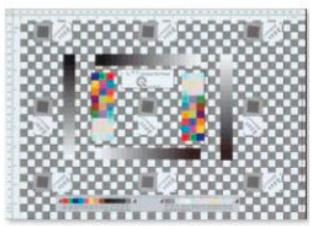
Figure 2: Examples of measuring tools, also called targets or test charts
(Creation: Michel Pfeiffer – CC BY 4.0)



Golden Thread Device Level Target GT DLT DICE_01

Golden Thread Object Level Target GT_OLT DICE_01

IA Scanner SRF und OECF Target QA-62



IE Universal Test Target_UTT

TE263

X-Rite Color Checker Passport

X-Rite Color Checker SemiGlossy_CCSG

X-Rite Mini Color Checker

Measurement software for quality control of digital image data

The test targets, however, are only one half of the story, because in order to measure actual values we need the appropriate software. The easiest tool to use is the Delt.ae online platform developed by the Picturae company. This platform can currently be used free of charge; you only need to register before logging in. A simple documentation with the supporting targets and other information can be found in the relevant wiki (https://deltae.picturae.com/wiki). In principle, the data are uploaded to a (foreign) server and analyzed. To assess the results, the user can choose between the Metamorfoze and the FADGI standard. The results will then be displayed in red or green, depending on whether they meet the criteria and tolerances. With just another mouse click, the individual measured values can be evaluated and understood in detail. This tool provides a simple, intuitive approach to the topic and can be used to precisely and easily adjust a reproduction installation or scanner.

It has been known for some time that this platform will no longer be developed. That may be one of the reasons why the current ISO standard is not supported. How long the tool will remain available for use is uncertain. Users also need to be aware that the image data end up on a foreign server. If you want to avoid this, cut out the target and upload this only, which also saves you from having to wait a long time for the data to be uploaded and analyzed.

In addition to Delt.ae, there are also various, mainly fee-based tools which are more precise yet also considerably more complex. Worth mentioning here is the Golden Thread Analysis Software developed by Don Williams, which is ideal for testing the FADGI standard. A comparable alternative is the open source tool OpenDICE. The configuration of this tool, however, requires a great deal of expertise. Last but not least, the modular iQAnalyzer developed by Image Engineering is also worth mentioning.

Quality criteria

Although FADGI differentiates between 13 measurable criteria, this contribution is limited to the six key criteria that the author considers crucial as an introduction to the subject. These are relevant to understanding and implementing the Metamorfoze standard, which is widely used in Europe. This selection is by no way an assessment of the criteria; it serves purely and simply to reduce the degree of complexity.

1. Geometric representation

Rotationally symmetrical glass bodies are prone to imaging errors, i.e. distortion that appears pillow-shaped or barrel-shaped. In objective lenses, concave and/or convex, spherical or aspherical lenses are combined in such a way as to correct or minimize these imaging errors. The more precisely the lens combinations are calculated and ground, the smaller the imaging errors caused by the lens.

Reproduction lenses have very strict requirements. On the one hand, the lens combination on the image sensor (CCD or CMOS chip) which records the picture should be highly accurate in order to minimize imaging errors. On the other hand, they should also fit together, because it is the optomechanical system as a whole that is ultimately responsible for the imaging result.

The situation is further complicated by the fact that the recording system (viewing direction) must be at a right angle to the original image. If this is not the case, i.e., if the

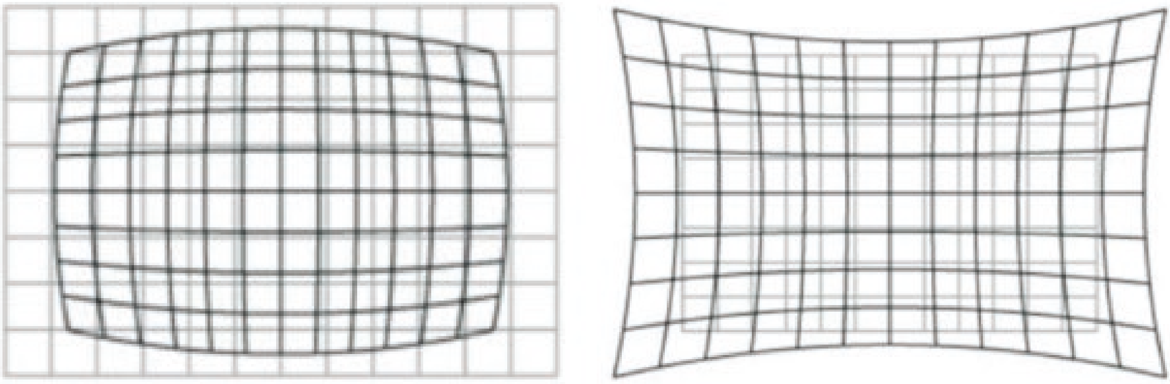


Figure 3: Pillow-shaped and barrel-shaped distortion
(Creation: Michel Pfeiffer – CC BY 4.0)

image plane is not parallel to the recording plane, then convergent lines will occur. The recording system would, in this case, represent a rectangle as a trapezoid (see Figure 4). If there are parallel lines, as with a photograph, the problem is relatively easy to recognize. Without these lines, the imaging error eludes our perception.

When using flatbed scanners, the image lies on a glass surface and is pressed flat by the lid. The manufacturer aligns the image receiver with the glass surface, thereby creating parallelism within a closed system. Distortion on a flatbed scanner is therefore caused solely by the lens and the scanning mechanical feed. With an open system such as a repro camera, the parallelism between the image plane and the recording plane must first be created and checked at regular intervals.

Geometric distortion is therefore the first criterion to be taken into consideration in order to ensure that a square is not represented as a rectangle and that a circle is displayed as a circle and not an ellipse. For maps, plans and aerial photographs this is obviously a crucial requirement.

This criterion is determined to a great extent by the lens inserted in the camera. Normal compact lenses for digital SRL cameras are often limited in terms of their performance, while zoom lenses do not comply with the given measurements. Perfect parallelism between the camera and the image original is, at least in theory, a less important aspect of this criterion. In practice, however, this complex operation, which requires patience and attentiveness, should not be underestimated.

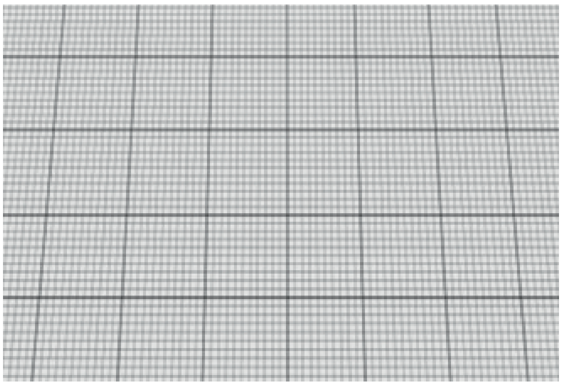


Figure 4: Convergent lines can be prevented by precisely aligning the recording plane (sensor) with the original (object) plane.
(Creation: Michel Pfeiffer – CC BY 4.0)

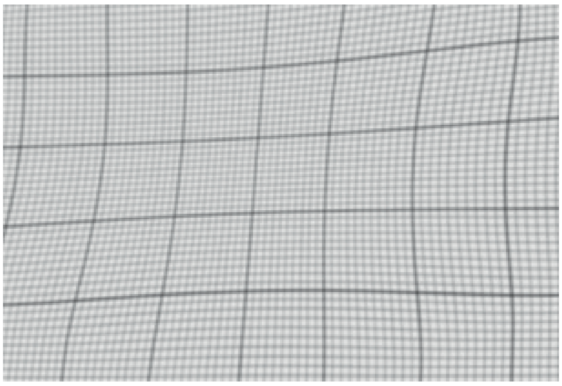


Figure 5: A deliberately exaggerated simulation of all forms of geometrical distortion, which do not occur to such a serious extent in practice.
(Creation: Michel Pfeiffer – CC BY 4.0)

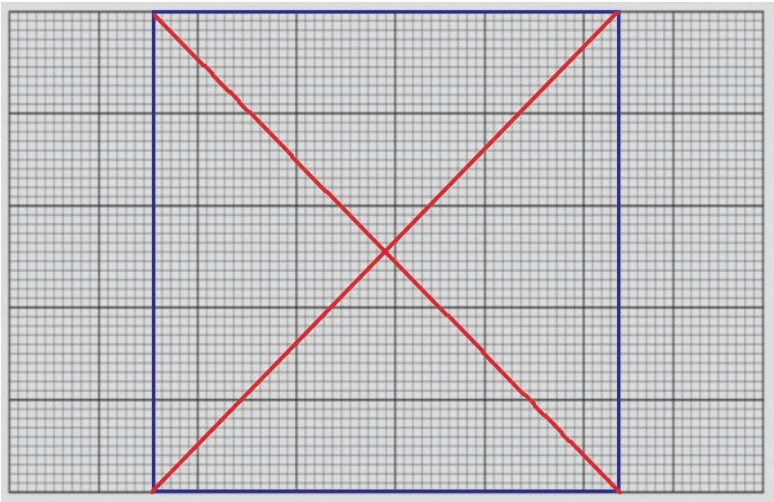


Figure 6:
A practical way of checking distortion

By digitizing a sheet of graph paper so that the total area of the chip is filled in, the sum of all the geometric distortions can be visualized and their proportions checked.
Metamorfoze, for example, stipulates that the total amount of distortion must not exceed 2% (see Metamorfoze, p. 27, Bibliography and Useful Links). Details on how to take measurements are set out in ISO standard 17850:2015. Figure 5 makes it clear what this criterion seeks to avoid in practice. The distortion is measured using the QA2 test chart, but by following a pragmatic approach, this goal can also be achieved without the need for expensive instruments. After correctly setting the reproduction scale of the pixel density to be achieved (see next point), align a sheet of graph paper so that it is exactly in the center; the hidden guidelines in the viewfinder or in the camera control software will help with this. Now digitize the graph paper and observe the corners. A good level of alignment is achieved when the horizontal and vertical lines in the corners each deviate by less than about 0.5 mm. With the most common formats and pixel densities, between A3 and A4, good alignment results can be achieved. In the case of larger formats, the deviation may be greater. If the images to be digitized are smaller, then the camera should be aligned until the lines in the corners show almost no visible differences. To speed up the process, a laser beam reflected by a mirror attached to the lens can be used. A good level of alignment is achieved when the laser beam and the reflected beam meet centrically.
The result of the distortion can be checked using Photoshop (Figure 6) by measuring the diagonals of the largest square on the recorded area, which should be identical.
The approach outlined here provides practical and pragmatic results. In practice, distortion problems are recognized by the fact that sharpness is not identical across the whole surface and is reduced in the left or right corners.

2. Imaging performance and scale

In general, we refer to the number of pixels per length as the resolution. The higher the resolution, the finer the structures that can be imaged. Originally, a distinction was made between resolution in pixels per inch (ppi), which is the measurement used in scanning, and the number of dots per inch (dpi) used in printing, which correspond to the number of ink dots necessary for the output in offset printing. Many manufacturers and authors no longer make this distinction, and this often leads to misunderstandings. Basically, the concept is the same: the density of pixels required to reproduce an image. It therefore makes sense, from this point on, to speak about pixel density.
Pixel density always refers to the number of points per unit of length or area, because it is basically assumed that the vertical resolution corresponds to the horizontal, and vice versa. If the pixel density is doubled, then the actual number of pixels increases fourfold. The size of a digital

image is thus determined by the number of pixels present in the length multiplied by the number of pixels in the width. This measurement is an absolute value and generally independent of the resolution. The latter is relative and therefore a piece of metadata that is instead responsible for the correct true-to-scale visualization of an image file.

The quality assurance standards mentioned above specify different pixel densities depending on the medium and format of the original document. We basically no longer need to bother about resolutions, which can be implemented. Metamorfoze, for example, stipulates that objects larger than A2 must be digitized at 150 ppi. Objects between A2 and A3 can be digitized at 300 ppi, and those smaller than A6 must be digitized at 600 ppi in order to retain sufficient detail (see Metamorfoze, p. 25/26, Bibliography and Useful Links). This is important for reflective light templates, but not for transparent media such as slides or negatives. For these media, you should currently consult FADGI.

Many image records that can be seen online today were not digitized to scale in the past. There are many reasons for this, though often it is simply a metadata problem. A common cause is a wrong or misinterpreted manual adjustment of the image resolution.

The advantage of true-to-scale digitization is that digital reproductions can be measured using digital measuring instruments. This can only work if a) the geometrical representation is correct, b) the optical resolution of the distance between the image sensor and the original is correctly set, and c) the metadata of the image resolution are set correctly in the file header. If these conditions are met, a length of 10 cm is in fact displayed as 10 cm in the digital representation. For manual testing, test targets have a scale displayed in centimeters and inches. In addition, models can be used to calculate the resolution.

Let's assume that our measuring length of 10 cm was digitized at 300 ppi. We now divide the 10 cm by 2.54 (2.54 cm = 1 inch), which gives us 3.937 inches. The scale is respected if 3.937 inches equal 1181 pixels. To achieve this, we multiply our length of 3.937 inches by the resolution of 300 ppi (pixels per inch). Thus 1 cm on the digital reproduction corresponds to 118 pixels, and exactly 11.8 pixels are displayed in 1 mm.

In closed systems such as scanners, the equipment manufacturer calculates various optical resolutions or the distance between the image recording system and the original. These resolutions can be retrieved via the software. But how can the optical resolution be harmonized with the scale of a digital camera fixed to a repro stand? To do this, we need to perform a small calculation.

In practice, we have first to take a picture using the repro system with the lens we are going to use. Then we read the number of pixels effectively recorded on the long edge.

Our camera system delivers 5996 pixels. We now set it to digitize at 300 ppi. This means all objects that we place under the recording system – irrespective of how big they are – will be digitized with a pixel density of 300 ppi.

If we now divide the 5996 pixels by the desired resolution of 300 ppi, this will give us 19.89 inches or 50.76 cm (multiplied by 2.54). If we record the measured length of 50.76 cm on graph paper and then move the camera down the reproduction frame until the measured length is reproduced precisely on the chip – no more, no less –

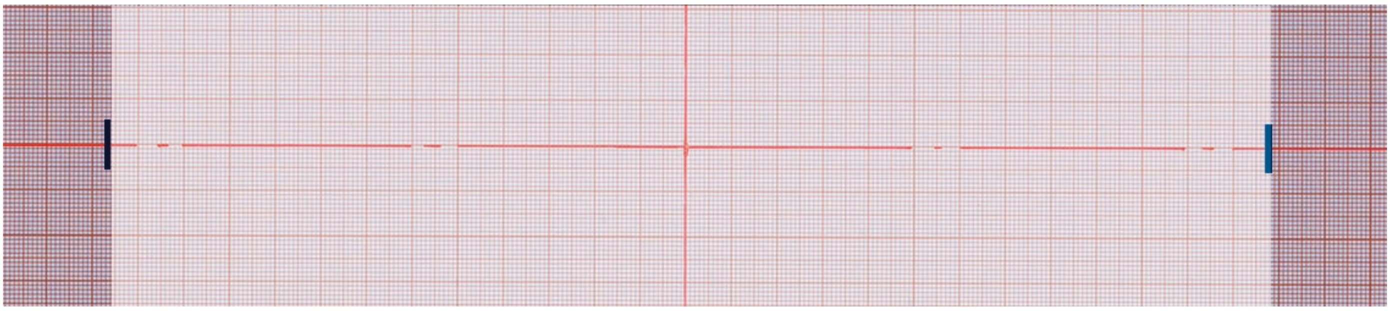


Figure 7: The calculated control measurement of 300 ppi is digitized so that only the image area within the control measurement is reproduced on the chip (the pale area delimited by the vertical lines).
(Creation: Michel Pfeiffer – CC BY 4.0)

then the setting on the column of the repro camera corresponds to 300 ppi. We can now simply attach a small sticker to mark the point on the column so we do not have to repeat this procedure every time.
Having done that, we still need to adjust the metadata of the image file, as this still does not know the pixel density. To do this, we set the relative resolution value to 300 ppi. If the images are then opened in an image editor, using the scale tool will allow us to digitally measure the original with millimeter precision. Scale is not an explicit quality criterion, but rather a general concept; an implicit factor on which other criteria are built.

3. Resolution efficiency

Resolution is not, however, the be all and end all. Let's imagine a 300 ppi image that is not perfectly sharp. Although the data indicate 300 ppi, the latent blurring causes many details to be lost. Resolution therefore depends on sharpness. The same happens when images have insufficient data or little contrast: They appear blurred. In short: Resolution, sharpness and contrast influence each other. So basically, during the entire recording process we need to ensure that the influencing factors mentioned above do not accumulate negatively.
How do we define 100% sharpness? The starting point for calculating 100% sharpness is pixel density. 300 ppi makes for a good example to explain this topic, as we are already familiar with it. We previously calculated that a pixel density of 300 ppi corresponds to 11.8 pixels per millimeter. If we were to draw a line for each vertical pixel, it would only be practical to count them if the black and white lines were alternating. In theory, we would therefore have to represent 5.9 line pairs per mm – the unit of measurement is therefore lines per mm, abbreviated as l/mm. If we now record and digitize these 5.9 pairs of lines, then 100% sharpness is achieved when we are in fact able to reproduce them all. In theory, at least, because in practice every optomechanical system incurs information losses. Currently, good high-performance systems are able to reproduce 5.6 pairs of lines using purely optical means, without any digital resharpening.
The Metamorfoze standard sets the minimum resolution efficiency at 85% (see Metamorfoze, p. 26, Bibliography and Useful Links). Images that have an imaging performance of less than 5 line pairs are considered inefficient by Metamorfoze; they are out of focus and therefore unacceptable.
To measure pixel density and resolution capacity, the Modulation Transfer Function (MTF), a contrast transfer function and Spatial Frequency Response (SFR) are used. The MTF measurement is based on the difference in contrast between the original image and the digital image. A distinction is made between MTF 10, which measures sharpness, and MTF 50, which measures

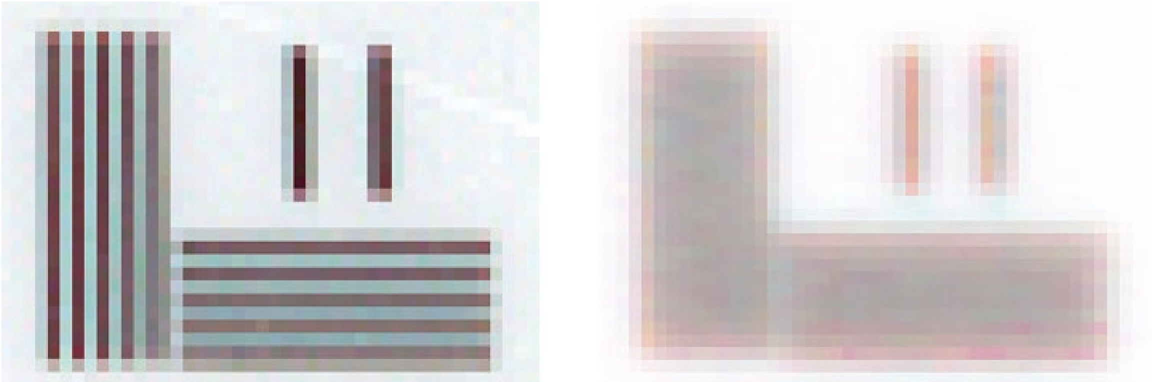


Figure 8: The pair of lines in the image on the left is sharply depicted; the pair of lines with the same resolution on the right is blurred. The images differ in their reproduction efficiency.
(Creation: Michel Pfeiffer – CC BY 4.0)

the sharpness of the contours. SFR, on the other hand, measures the performance of the imaging system, i.e. its capacity to maintain contrast as image details become smaller and smaller. The MTF and the SFR functions allow us to precisely determine the pixel density.
The corresponding measuring process is defined in the standards ISO 12233:2000, ISO 16067-1:2003 and ISO 16067-2:2004. Metamorfoze tolerates a deviation in pixel density of up to 2% at most. In the example using 300 ppi, the lower tolerance is 297 ppi and the upper tolerance is 303 ppi (see Metamorfoze, p. 25, Bibliography and Useful Links).

4. Noise

The occurrence of statistical fluctuations of all electronic measurands is defined as noise. With regard to the process of digitizing images, noise is produced by pixels that disturb the digital photos by having the wrong color and brightness values. The purity of a signal is measured by the so-called signal-to-noise ratio (S/N), which measures how strongly the useful signal is affected by noise. Metamorfoze allows a maximum deviation of 1.5%. In the case of a color depth of just 8 bits, this corresponds to 4 pixels only, but in a 16-bit file, it can affect 1024 pixels (see Metamorfoze, p. 9, Bibliography and Useful Links).

When imaging sensors were first being developed, noise was an ongoing challenge and manufacturers struggled with different approaches. Today, these initial problems have been resolved; if modern-day reprographic systems were still really noisy, under the correct exposure conditions, then it would be impossible to sell them. Noise limits can be sounded out by increasing the ISO sensitivity of the camera, which is definitely not recommended in professional, productive use.

5. Tonal range

Metamorfoze measures the tonal range in terms of exposure as well as grayscale contrast (gain modulation). For exposure, the standard provides an acceptable tolerance of Δ L*2 (two points on the luminance axis in the Lab color space). The tonal range is also influenced by the white balance; in this case the tolerance amounts to Δ C*2. The white balance ensures that the individual color channels are properly harmonized. With grayscale contrast, the issue is whether the contrasts between the individual scales of grey are transferred correctly. The objective is to achieve as stable a grey axis or curve as possible, and this is directly influenced by exposure. These three criteria – tonal range, grayscale contrast and white balance – mutually influence each other.

If the tonal range is not correct, image information is lost and undesirable changes in color occur. In practice, the tonal range can be effectively, though not scientifically, checked by using the histogram function. If the ColorChecker SG is digitized in full format and with the correct exposure, the histogram +/– corresponds to the normal (Gaussian) distribution. Under closer examination, field E5 should have a value of 246 after white balance in the ECIRGBv2 color space. Taking into account the tolerance outlined above, E5 should be no higher than 251 and no lower than 241.
If the tonal range is correct when recording in the RAW state but not in the exported result, the problem lies in the configuration of the corresponding color management components. Depending on the measuring software and target used, the tonal range may or may not be analyzed. This parameter, however, always influences color accuracy. Given that it is the consequence of tonal range, color accuracy can be analyzed using all software tools.

6. Color accuracy

The last important aspect is color representation. This criterion determines how great the allowed difference is between the colors to be digitized and the digital colors that are imaged.
Technically speaking, color values can be understood as coordinates in a specific color space. Depending on the color model and space, they describe positions on their respective reference axes, where perceptible color differences indicate different locations. Differentiable differences in color therefore show up as distances between these locations, which are measured and represented as DeltaE.
Color accuracy is therefore achieved when color values deviate only minimally throughout the color space. Due to physical and mathematical factors, this is no trivial requirement; indeed, there are several different approaches and formulas for calculating distances between colors. It therefore comes as no surprise that there are no consensual tolerances within the various standards with regard to distances between colors and measuring methods.
Color differences with a DeltaE value of greater than 6 are generally perceived to be large. If the differences are between DeltaE 6 and 3, we speak of medium color deviations, whilst slight color deviations lie between DeltaE 3 and 1. Distances between colors of below DeltaE 0.2 are generally considered imperceptible. Metamorfoze basically differentiates between the deviation of a single color value and the average deviation of all colors on the ColorChecker SG test target developed by the XRite company. For the two Metamorfoze quality levels “light” and “extra-light,“ the maximum permissible deviation for a single field is DeltaE 18, though on average the fields must be DeltaE 5 or lower. This color deviation tolerance should essentially be respected if visual cultural assets are to be archived and passed on over the long term. The majority of color accuracy issues that arise in relation to digitized cultural assets can thus be satisfactorily addressed.
If the object is to be reproduced with perceptible exactness, then the distances between colors should be reduced. Depending on the literature, this tolerance is referred to as either “full” or “strict” in the Metamorfoze standard. The maximum permitted distance between the colors of a single field must be no higher than DeltaE 10, and the average value no more than DeltaE 4. In practice, these are

uncompromising values which impose not only high quality requirements on the hardware and software, but also require a great deal of expertise.

Influencing factors

Color accuracy essentially reveals a summary of previously incurred mistakes. This starts with the material structure of a lens, which is responsible for refracting light. The higher the glass quality of a lens, the better the overall result. The calculation and the material structure of the lens(es) directly affect the refraction and thus the reproduction of color, the geometric representation as well as the physical resolution or the maximum possible performance in terms of sharpness and contrast. The white balance is particularly important and can balance out many things. According to Metamorfoze, this operation is carried out using the ColorChecker SG target in the field G5 (see Metamorfoze, p. 18, Bibliography and Useful Links).
If the average color distance values lie outside the tolerances, check that the recording surface is evenly illuminated. It should be under one EV. Likewise, the ideal type of exposure must be adhered to (see tonal gradation).
On the digital side, it is important to check or optimize the color profile of the camera as well as the in-camera functions responsible for processing the export data (often gradation curves). The prerequisite for color management to work properly is a correctly configured operating system. Identifying the real causes of any lack of quality for this criterion is therefore an arduous and complex undertaking. This measurement criterion, in particular, crucially depends on the accuracy with which the measuring surfaces (targets) used were produced. Ageing of the measuring fields or dust on the measuring surfaces are also aggravating factors.

Use of the Delt.ae platform and interpreting the data

The Delt.ae platform is relatively easy to use. To speed up learning about the use of quality control, it is good to know where the criteria described manifest themselves (see Figures 9 and 10).
First, select the quality standard in (1), against which the original document will be checked. In this case, Metamorfoze light has been selected. It incorporates all the set values of the respective measurement criteria and tolerances that were outlined above and are explained in detail in the Metamorfoze guidelines. Delt.ae does not allow these criteria and tolerances to be changed. Depending on the standard chosen (1), the quick view (2) changes. In the Metamorfoze mode (above), the fulfilled criteria are marked with a green checkmark, but when switching over to the FADGI mode (below), the characteristics are shown as a number of filled (blue) stars. In order to view the effective values, click on “View mode” in the top right-hand corner to display the values. This can be quite handy, depending on the workflow.
Delt.ae provides an immediate assessment on the image quality achieved based on the test chart used. In area (3), the summary result of all analyses is shown in binary, in green or red. The fourth area (4) shows the metadata embedded in the file. In the same field further down (not shown), the measured values can also be downloaded as a CSV file or ICC profile.
By moving the cursor over the results displayed in area (3), individual measured values become visible. The display changes according to the test chart or measuring surface.

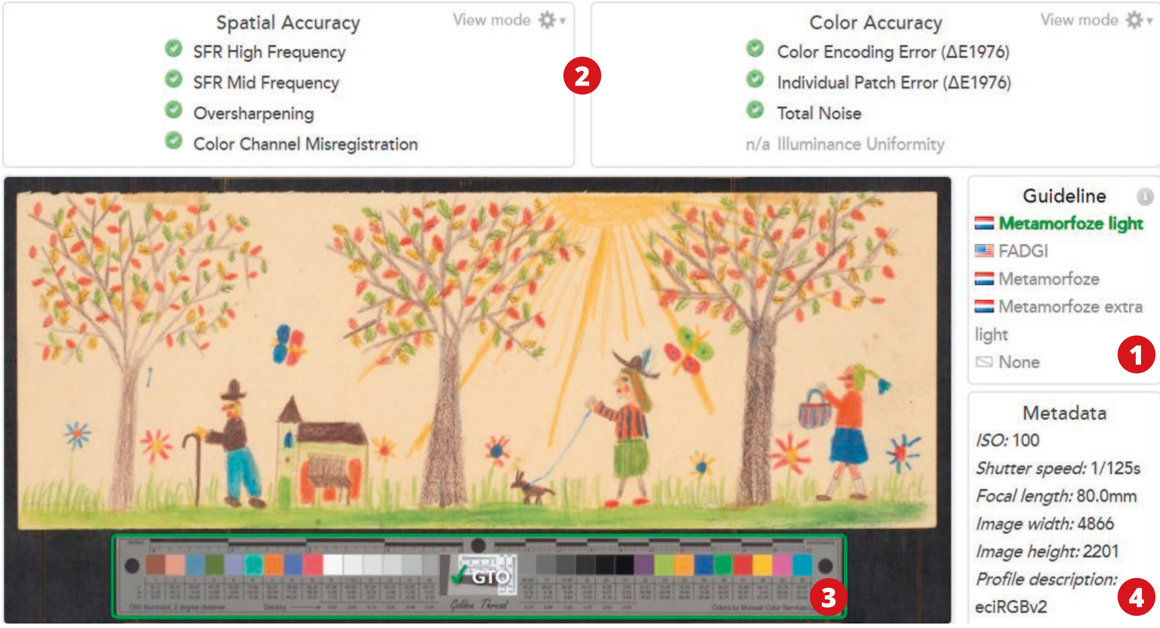


Figure 9: View of a single image in Delt.ae

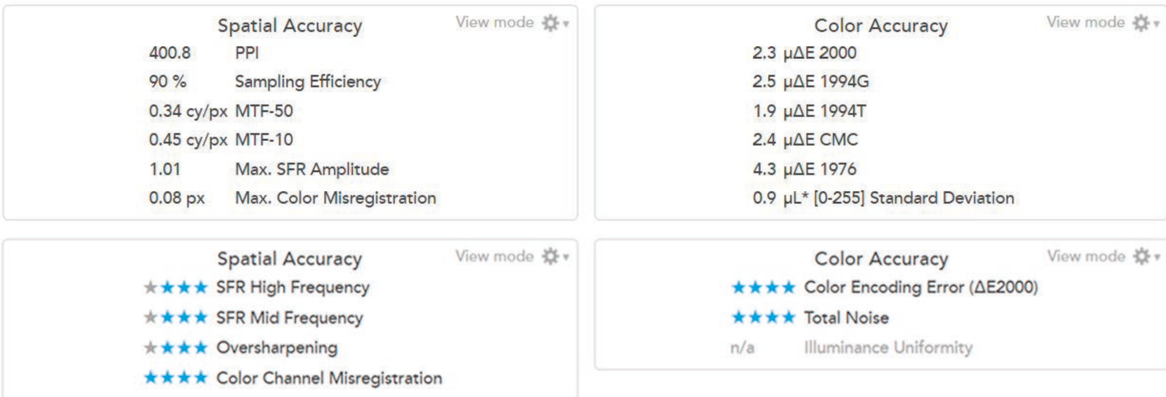


Figure 10: Overview of the measurement criteria in FADGI mode (below) with the detailed measurements above. The display is adjusted by clicking on the "View mode" gear.

Now we come to the most relevant measurement values (Figure 11). The first line shows the results of the color distance measurement (DeltaE). The results for the respective measurement methods are displayed from left to right. In the example given, it is easy to see that the measuring method greatly affects the result. If calculations are made using the formula developed back in 1976, the color difference is a DeltaE of 4.3. However, if the calculation from the year 2000 is applied, the supposed result with a DeltaE of 2.3 is much better. The second line shows that the resolution efficiency (SEFF) is 89%, followed by the Color Misregistration (CRM) value of 0.08 pixels, the value affected by the white balance, and the MTF 10 value. The latter describes the contrast transfer function in cycles per mm. The third line, which starts with the MTF 50 value of 0.34, gives the other results of the Modulation Transfer Function (MTF). The last line before the curve shows the effective pixel density in dpi, then the geometric distortion value (STDEV) and noise (S/N).

Metamorfoze does not permit the resharpening of digital data after production (see Metamorfoze, p. 26, Bibliography and Useful Links). This certainly makes sense for digital long-term archiving, because it is best to sharpen pictures individually only prior to being published for a particular purpose, taking into account image size and pixel density. This is done by increasing micro contrasts between light and dark pixels. This operation should, however, be avoided with regard to tonal grading. Digitally sharpened images can easily be identified by observing their curve. Horizontal curves or positive curves with an initial value greater than 1 are always resharpened. Nevertheless, the digitized document may fall within the criteria and tolerances.

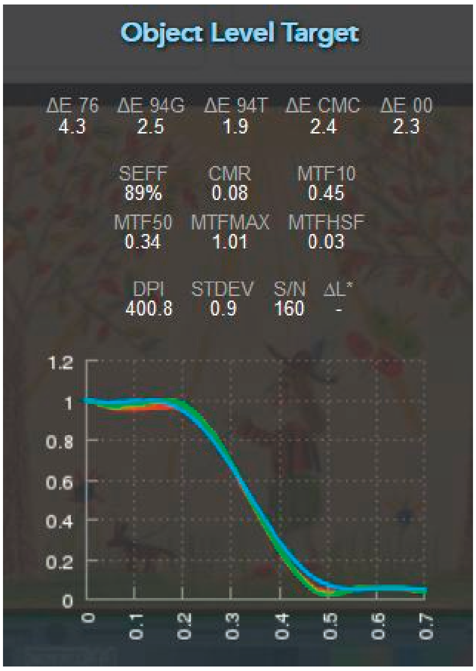


Figure 11: Results of the detailed object level target (OLT) analysis

By moving the cursor over area (3) and clicking on it, the binary green/red analysis of the individual measuring fields appears (Figure 12), providing a quick overview of which color channels may have escaped control. If the lighting provides a complete spectrum and is even, the exposure is exact, the white balance is correct and the color misregistration shows no unusual value, the next step is to check whether the correct results can be achieved by using a custom-made camera profile. If this does not help, it can be deduced that either a) the software system landscape is not working correctly, or b) the hardware used simply cannot produce the required quality.

By clicking on the green squares of the individual patches in Figure 12, detailed values for each individual field clicked on will appear. Figure 13 shows the specific sharpness values (SEFF, MTF, etc.) for the "Edge V" field, while Figure 14 depicts the actual Lab values for Patch 10.

The corresponding theoretical Lab values of all the patches are printed on the test

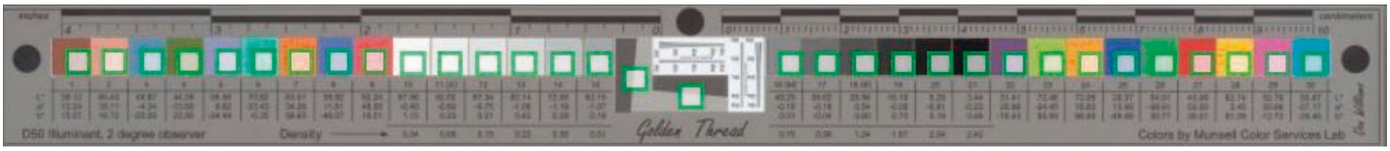


Figure 12: Detailed results of the analysis

(Screenshot: Michel Pfeiffer – CC BY 4.0)

chart and thus documented in a form that can be read by humans. This is of great benefit for digital long-term archiving, but only if the test charts or targets remain attached to the digitized image document, i.e. if they are also saved and archived. It does take up a few more MB or GB of storage space, of course, but merely making the technical traceability of image quality possible more than justifies this move. If current or future technologies fail, future generations will be able to clearly reconstruct the data as faithfully to the original as possible on the basis of these printed, attached target values. This is what standards such as Metamorfoze are committed to ensuring.

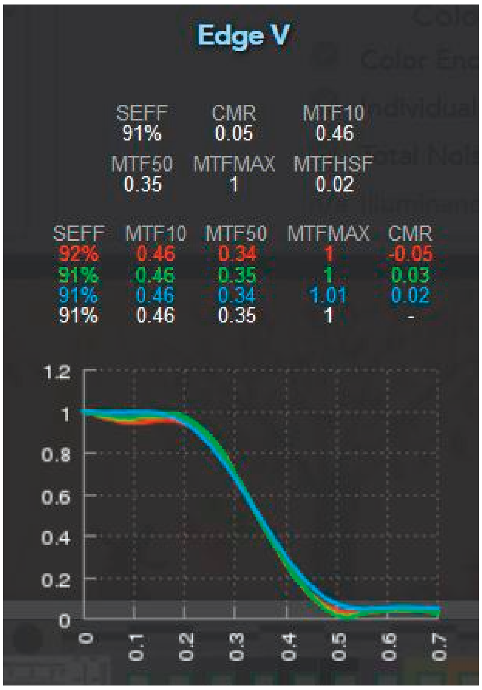


Figure 13: Detailed results of the analysis for the “Edge V” vertical edge field which outputs the vertical measurement values; these are normally different from the horizontal values shown in the “Edge H” field.

(Screenshot: Michel Pfeiffer – CC BY 4.0)

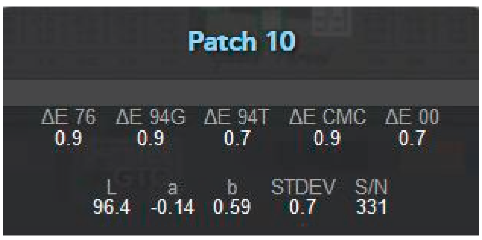


Figure 14: Detailed color values for the “Patch 10” field

(Screenshot: Michel Pfeiffer – CC BY 4.0)

The author

Dr. Michel Pfeiffer was born in 1966 in Thalwil (Switzerland); he completed his Master studies at the Department for Image Science of the Danube University Krems, and a PhD on collection strategies and assessment criteria for visual heritage education at the Institute for Contemporary History of the University of Vienna; he lectures at the Swiss Institute for Information Science at the Graubünden University of Applied Sciences in Chur, Switzerland; since 2015 he has been a Professor, Head of the Digitization Laboratory and responsible for the “Digitization” lecture series in further education; he is also a lecturer at the Danube University Krems in the Department of Digital Collection Management. Fields of research: digitization, preservation and mediation of (visually coded) cultural assets – in particular object data and metadata – between libraries and archives.

Bernhard Mertelseder

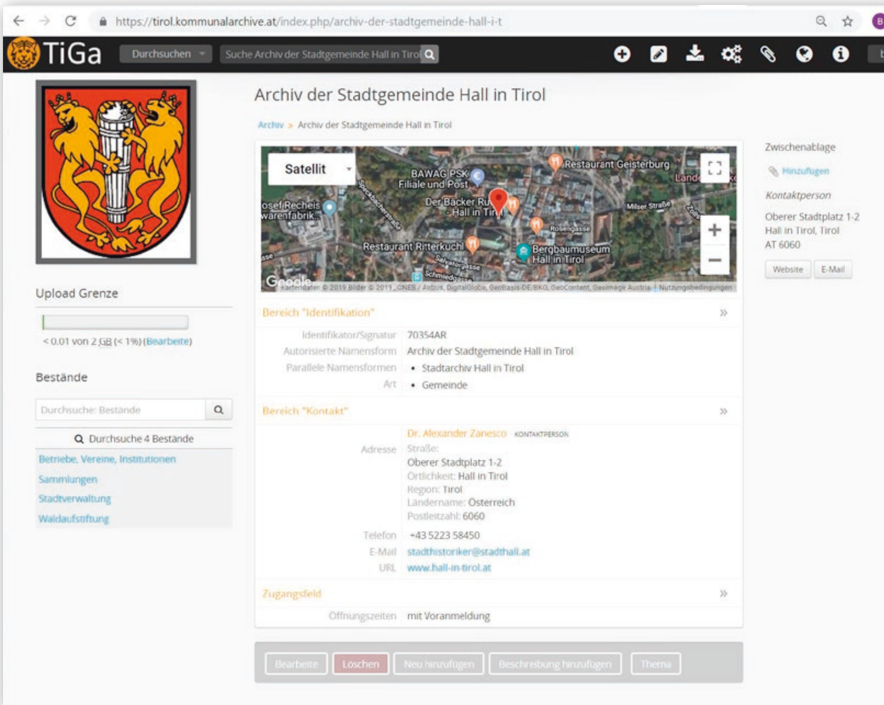
TiGa

An archive information system for the municipalities in the province of Tyrol

The Tyrol Archive Act came into force in early 2018, leading to the creation of TiGa ("**Ti**roler **G**emeinde**a**rchive"), a standardized archive information system (AIS) for all municipalities in Tyrol. It is based on the open-source, royalty-free AtoM software (www.accesstomemory.org), which was developed for use in archives, museums or libraries without in-house, archive-specific IT infrastructure. AtoM is browser-based, which means no components need to be installed on the user's local PC. Archival material can be searched for and gathered using any computer with Internet access. It also allows the user to publish index information online with a simple mouse click.

The software not only complies with the common archive-specific standards such as ISAD(G), ISDIAH and ISAAR(CPF); it is also multi-repository, meaning that on the one hand, it enables the cross-archival search for and presentation of information, and on the other, it allows access rights to be individually assigned for every single archive.

The portal can be found online at tirol.kommunalarchive.at and is constantly being expanded. What is particularly interesting in terms of its content is the possibility of jointly managing and presenting written records and images, as well as managing other digital objects and making them available. Networking archival materials and collections – such as photographs – is not only in keeping with the times; it also promotes the connection and dissemination of available knowledge.



The homepage of a municipality on the TiGa portal, in this case the town of Hall, with all basic information about its archive. Below the town's coat of arms is the list of inventory groups.
(Screenshot: Bernhard Mertelseder, CC BY 4.0)

The author

Bernhard Mertelseder, M.A., was born in 1970 in Brixlegg in Austria; he studied History and Romance Studies at the University of Innsbruck and Archival Science at the Potsdam University of Applied Sciences; he works as a historian and archivist; since 2006 he has been a consultant to the Tyrol Chronicle and Communal Archives within the framework of the Tyrolean Education Forum (TBF); several publications on the history and commemorative culture of Tyrol in the 19th and 20th centuries.

Raimund Rechenmacher

Data Backup for Chroniclers in the South Tyrol Municipal Association Cloud

Chroniclers in South Tyrol have the opportunity to contact their municipality and request storage space in the South Tyrol Municipal Association's cloud, where they can securely store their data.

1. Apply for access to the cloud through your municipality

A username and password will then be issued. The password needs to be changed every three months.

2. What do I want to back up?

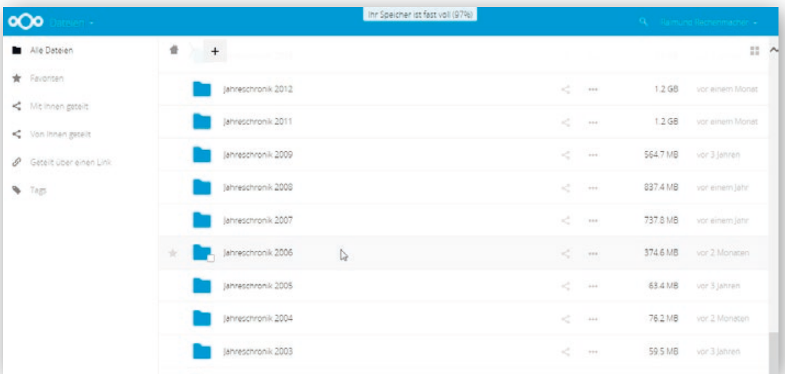
Consideration must be given to which files should be backed up (photos, texts, scans…). These must then be stored in the cloud, which can be reached at the following address: cloud.gvcc.net/gemeindename/ (enter the name of your municipality in place of "gemeindename"). If large amounts of data need to be stored, it is advisable to save them onto a DVD or USB flash drive and deliver them directly to the Municipal Association, or else data transmission would take too long. You will need to arrange a personal appointment for this purpose with the South Tyrol Municipal Association: phone +39 0471 304639.

3. Automatic backup

The "nextcloud" program lets the user define which files and folders on your PC are regularly backed up in the cloud. As a result, changes to files, even large ones, are automatically synchronized on a regular basis. The nextcloud program can be downloaded here: https://nextcloud.com/clients/.

4. Work-sharing

Cloud storage is ideal for teamwork. The owner of the data can decide who can read, edit and share his or her files. That means multiple chroniclers can all work on the same document. All the members of the team must be registered users in order to be able to edit data.



User interface
(Screenshot: Raimund Rechenmacher, CC BY 4.0)

The author
Raimund Rechenmacher was born in 1962 in Silandro in South Tyrol; he studied Geography at the University of Innsbruck; since 1989 he has been serving as Head of the Mittelpunktbibliothek library in Silandro; he also coordinates the Silandro chronicler team.

Gertrud Gasser/Martin Kofler/Notburga Siller

The Interreg project “Lichtbild/ Argento vivo. Cultural Treasure Photography”

A Review

Historical photographs give us an insight into bygone days. Men, women and children, long since dead and whose names have often been forgotten, look out at us from the pictures. Since the middle of the 19th century, photography has witnessed the transformation of the landscape and society – and is, at the same time, one of the means through which this change has taken place. The techniques and functions of photography, but also the profession of photographers, have likewise changed. This Interreg project is dedicated to the fascination of historical photographs and seeks to impart the skills required to preserve them permanently as important sources.

Since the project began in 2017, there have been various continuing education events on key topics in the ongoing historical photography debate. These include the history of photography with a focus on Tyrol, South Tyrol and Trentino, questions about photographic rights, as well as about techniques and methods for archiving photograph originals and analyzing their content, how to digitize and edit digitally reproduced photographs, as well as the great challenge posed by the long-term archiving of digital files. A total of five events took place from September 2017 to January 2019 at different locations within the project area: the Franzensfeste Fort, Eurac Bolzano, Brunico Castle, the Tyrol Chamber of Commerce Lienz and finally the Armory in Innsbruck. Experts from Italy, Austria, Germany and Switzerland gave talks on their fields of expertise. The events were free and open to all, and were simultaneously interpreted into German or Italian. Nearly 600 interested listeners attended the five workshops.

The contents have been made permanently available – either as a handout, such as the one you are reading right now, or in the form of an interactive, didactic e-learning course. Both versions are available in German and Italian, and the handouts were also translated into English. All these results will be collected and published on the Lichtbild/Argento vivo platform, the project website: www.lichtbild-argentovivo.eu. The aim is to provide anyone who is interested in these topics with the tools and instructions on how to handle historical photographs, and to guide and assist all those working with such images. The resources also present international regulations and standards. However, anything that applies to professional work carried out in archives, museums and other institutions may, to some extent, seem difficult for the layman to implement: Not everyone has the technical and financial means to achieve the model presented here. Yet it is important to be informed and to do whatever possible. The Interreg project partners remain at your disposal for advice should you have any further inquiries.

The Lichtbild/ Argento vivo team (from left to right): Arpad Langer, Gertrud Gasser, Verena Malfertheiner, Julia Knapp, Martin Sagmeister, Martin Kofler, Notburga Siller, Oscar La Rosa, Alessandro Campaner – Office for Film and Media, Bolzano, December 11th, 2018

(Photographer: Konrad Faltner, Office for Film and Media, Bolzano)

The project partners – TAP, the Municipality of Brunico, the Office for Film and Media/ Department of German Culture, in close co-operation with the Department of Museums – edit various pilot stocks from their photo archives. This means archiving the photographs, collecting them in a database, digitizing and publishing them. Most of these historical photographs from and about Tyrol and South Tyrol are available on the Lichtbild/Argento vivo platform for research purposes and can be downloaded free of charge. They can be accessed under the Creative Commons license CC BY in printable quality and without registering. This means that anyone can use these photographs, even for commercial purposes – the only condition being that the name of the respective archive as well as the respective photographer is published along with the image.

The image database, which – once the project ends – will contain over 12,000 pictures, is an open set of cultural data. The historical photographs are available for creative re-use, and also as machine-readable open data through the corresponding portals. As a means of making this open data known to the public, the project also took part in a “programming marathon,” a hackathon (the Vertical Innovation Hackathon by IDM Südtirol, November 2018). At such an event, computer programmers, developers and designers compete to perform a specific task in 24 hours, with each team seeking to present the best, most innovative and most exciting solution.

As part of the project, we also developed a mobile app for smartphones. The changes that locations in the city centers of Bolzano, Brunico, Lienz and Innsbruck have undergone can be understood all the better through historical photos. These snapshots – black and white, colorized and also in color – can be viewed in the “Timetrip Pics” app, which illustrates the development of the town and city squares in the form of a panoramic view or a timeline: Where once hackney carriages rode, the army was soon to march, and later tourism played a prominent role.

The project also organized several exhibitions. In the autumn of 2018, an open-air exhibition called “Platz da! Scesi in Piazza,” divided over four chapters, was staged simultaneously at open-air locations in Lienz, Brunico, Innsbruck and Bolzano, and was accessible around the clock. The exhibition used historical photographs as examples to illustrate which groups and institutions, clubs and associations, rulers and lone fighters had, over the course of time, seized important parts of the cities.

The “Frauenbilder. Signora Fotograf(i)a” exhibition staged in the early summer of 2019 in five chapters showed women in front of and behind the camera, and illustrated photography's role as a witness of change: The depicted themes of "Women's Lives," "Work," "The Photographer's Studio," "Women Photographers" and "Leisure" were displayed respectively in Lienz, Brunico, Bolzano, Innsbruck and Trento, with the latter being involved as a partner. The book accompanying the exhibition, which bears the same title and is edited by Katia Malatesta (Monuments Office of the Autonomous Province of Trento) and Martin Kofler (TAP), is not available in bookstores, but can be obtained from the individual partners involved in the project.

The digital exhibitions created during the project can be visited on the online platform. Photographs of the Kneußl family, taken between 1887 to 1964, trace the history of a family and at the same time the story of the historic changeover from Imperial Austria to South Tyrol and Tyrol. The geographical area covered by the project is connected by mountains, which the project's second digital exhibition illustrates through a diverse array of photographs ranging from the first ski tracks in the snow right through to color photos of modern ski-lift systems.

The Interreg project "Lichtbild/Argento vivo. Cultural Treasure Photography" is a collaboration between the following partners: Tyrolean Archive of Photographic Documentation and Art (TAP), the Municipality of Brunico, the Office for Film and Media and the Department of Museums of the Autonomous Province of Bolzano – South Tyrol. Associated partners are the South Tyrol Provincial Archives in Bolzano, the Tyrol State Museums and the Tiroler Bildungsforum (Tyrolean Education Forum) in Innsbruck as well as the European Region of Tyrol-South Tyrol-Trentino. The project ran from January 1st, 2017 to December 31st, 2019 and was funded by the European Regional Development Fund and Interreg V-A Italia-Austria 2014–2020. The results of the project are available permanently on the Lichtbild/Argento vivo platform at www.lichtbild-argentovivo.eu.

The authors

Dr. Gertrud Gasser was born in 1958 in Bolzano, South Tyrol; she studied Art History in Bologna and collaborates with the Museums Department of the Autonomous Province of Bolzano – South Tyrol; she is Project Leader of the Cultural Heritage in South Tyrol (KIS) project, and from its inception until 2019 was responsible for the Museums Department partnership within the Interreg "Lichtbild/Argento vivo" project.

Dr. Martin Kofler, M.A., was born in 1971 in Lienz in Austria; he studied History in Innsbruck and New Orleans, has worked on historical research and exhibition projects, is Director of the Tyrolean Archive for Photographic Documentation and Art (TAP) and responsible as Lead Partner for implementing the Interreg "Lichtbild/Argento vivo" project.

MMag. Notburga Siller was born in 1984 in Merano in South Tyrol; she studied History as well as Journalism and Communication Science in Vienna; she has taken part in social science research projects and has experience in the field of museums and communication; since 2017 she has worked on the "Lichtbild/Argento vivo" project at the Office for Film and Media in Bolzano, where she has been responsible for the project and media archive since 2018.

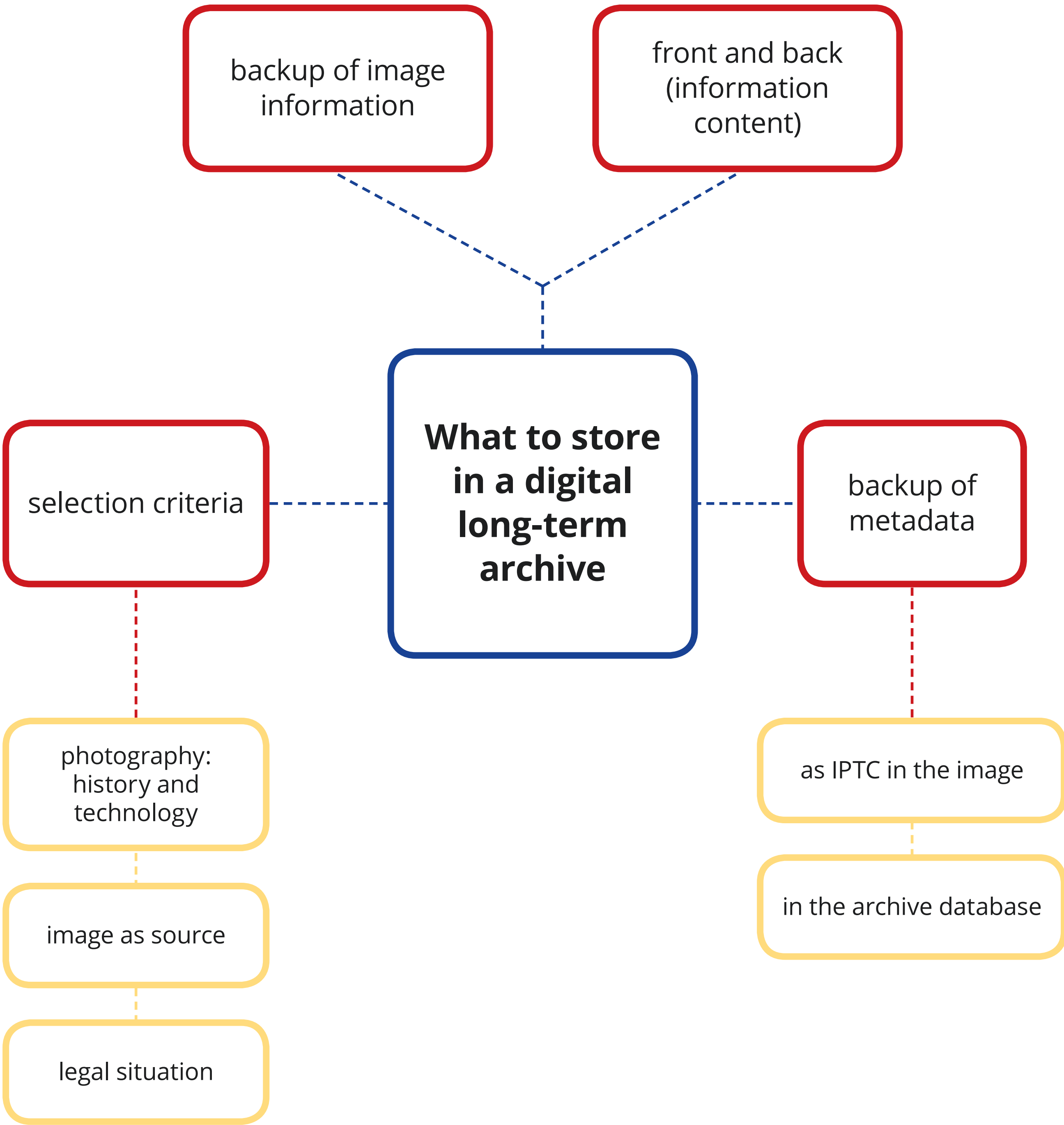
Notburga Siller

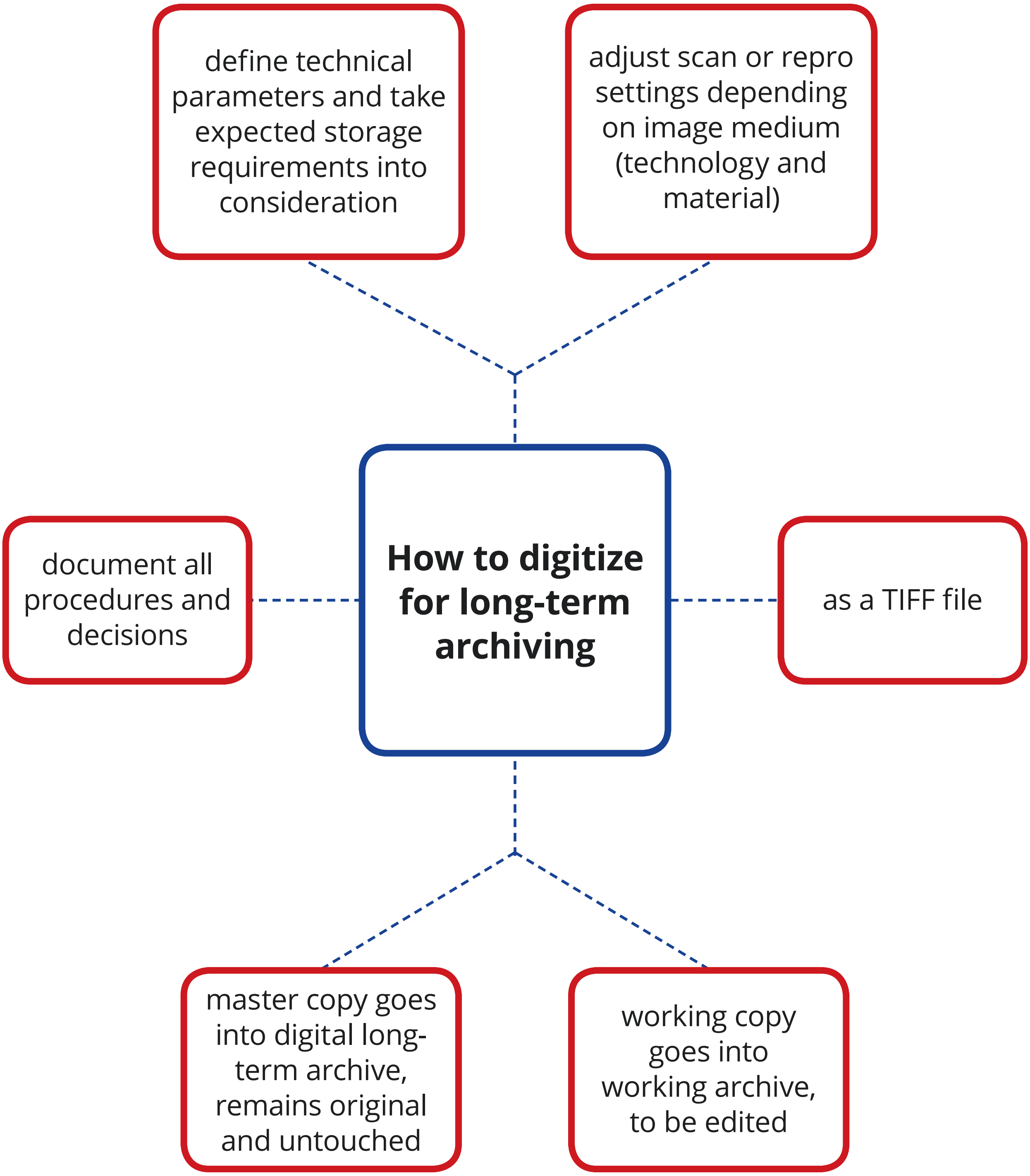
Digital Long-Term Archiving (DLTA)

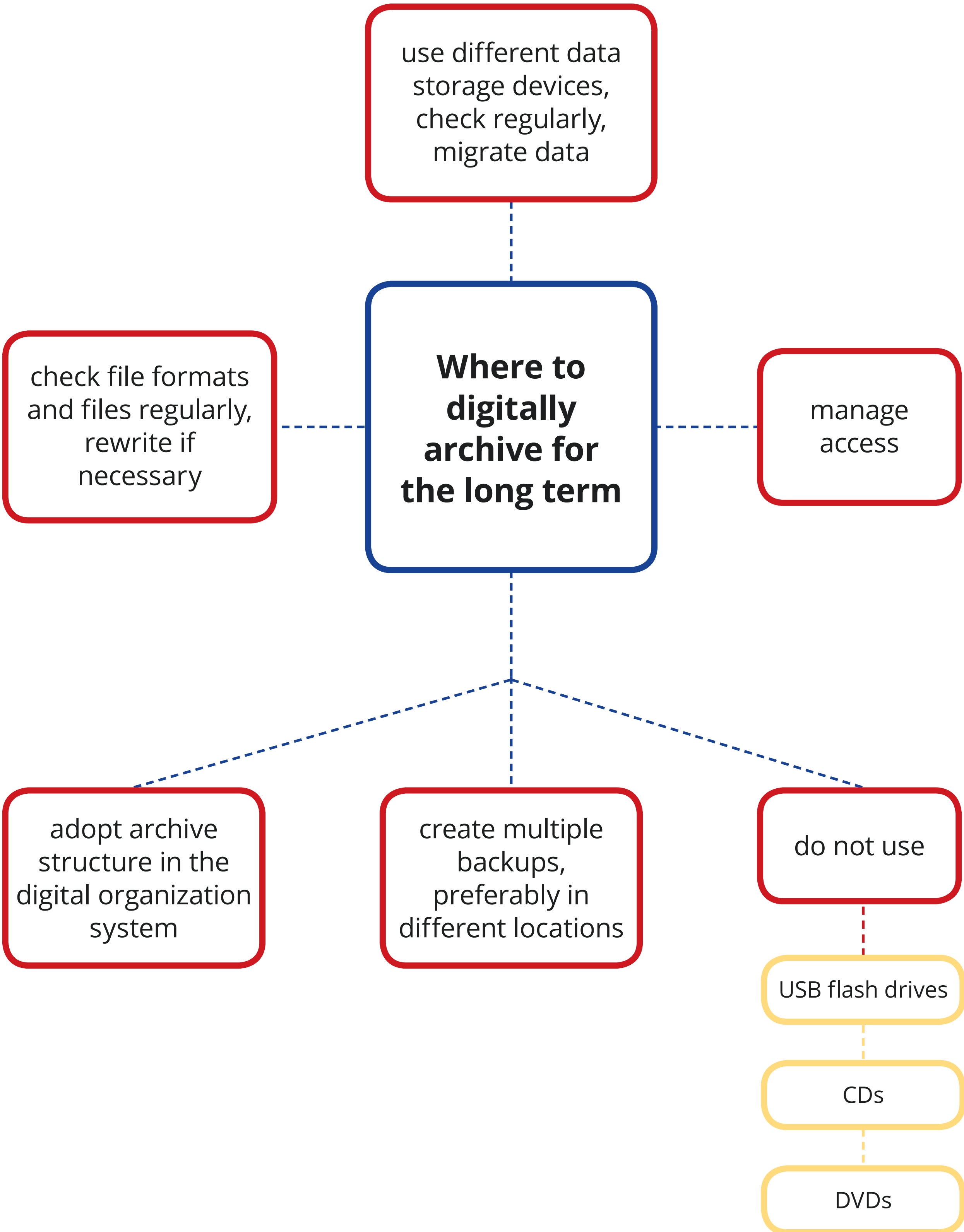
An Overview

Digital long-term archiving is about archiving digital files, i.e. zeros and ones, and therefore about preserving information about an image instead of an actual physical object. (Digital) long-term archiving must be planned and carried out in a systematic, organized manner. Digital data do not claim in any way to be eternal, yet they do have the advantage that they can be copied 1:1. Technical developments should be closely monitored because IT infrastructure, software, file formats and storage media are all transitory. Even a digital long-term archive needs to be maintained, checked and supplied.

Archived, indexed, digitized and also long-term archived in this form: View of the Marmolada, 1986. Digitized slide, freely available on the photo platform (Photographer: Franz Mayr; LAV039-01290, inventory Franz Mayr, Office for Film and Media, Bolzano, CC BY 4.0)


backup of image information
front and back (information content)
What to store in a digital long-term archive
selection criteria
backup of metadata
photography: history and technology
image as source
legal situation
as IPTC in the image
in the archive database


define technical parameters and take expected storage requirements into consideration
adjust scan or repro settings depending on image medium (technology and material)
document all procedures and decisions
How to digitize for long-term archiving
as a TIFF file
master copy goes into digital long-term archive, remains original and untouched
working copy goes into working archive, to be edited


use different data storage devices, check regularly, migrate data
check file formats and files regularly, rewrite if necessary
Where to digitally archive for the long term
manage access
adopt archive structure in the digital organization system
create multiple backups, preferably in different locations
do not use
USB flash drives
CDs
DVDs

Recommended Literature and Links

Literature

nestor-Handbuch: Eine kleine Enzyklopädie der digitalen Langzeitarchivierung – Version 2.3 (2010), edited by: Heike Neuroth, Achim Oßwald, Regine Scheffel, Stefan Strathmann, Karsten Huth: URL: http://www.nestor.sub.uni-goettingen.de/handbuch/index.php

Short guide to long-term archiving: URL: https://d-nb.info/1082230057/34

Links (July 29, 2019)

Recommended formats statement (for various types of media) from the Library of Congress: URL: https://www.loc.gov/preservation/resources/rfs/RFS%202018-2019.pdf

Paper reporting on experience: URL: https://www.semanticscholar.org/paper/A-Decade-of-Experience-with-Digital-Imaging-The-the-Williams/bef08a17a78775a3bc92339c34756dd25f1bfda2

FADGI – US Federal Agency Digitization Guidelines Initiative, an American standard for controlling image data quality: URL: http://www.digitizationguidelines.gov/guidelines/digitize-technical.html

MEMORIAV, photo recommendations, 2019: URL: http://memoriav.ch/foto/empfehlungen-foto/

Metamorfoze – Preservation Imaging Guidelines: URL: https://www.metamorfoze.nl/sites/default/files/publicatie_documenten/Metamorfoze_Preservation_Imaging_Guidelines_1.0.pdf

OAIS Reference Model (conceptual model) for long-term archiving: URL: https://public.ccsds.org/pubs/650x0m2.pdf

Quality controlled scanning: URL: https://support.imageaccess.de/downloads/product_manuals/FAQ/FAQ-Quality-Controlled-Scanning.pdf

Tool for checking whether TIFF files conform to the standard: URL: http://dpfmanager.org/

10 tips for maintaining digital image quality: URL: http://www.imagescienceassociates.com/mm5/pubs/50Arch07BurnsWilliams.pdf

Professional Handling
Open Access
Photography Goes Future