Metamorfoze Preservation Imaging Guidelines, version 1.0

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Abstract

The Metamorfoze Preservation Imaging Guidelines version 1.0 is published earlier this year. The guidelines are input oriented and relate exclusively to the image quality of the first file. All the desired output (derivatives) intended for print and/or the Internet can be made from this first file. In these guidelines this first file is referred to as the Preservation Master. The guidelines are intended for the digitalization of two-dimensional materials such as manuscripts, archives, books, newspapers and magazines. They may also be applied for digitalizing photographs, paintings and technical drawings.

These guidelines should be considered the image quality standard of Metamorfoze Preservation Imaging. This means that the guidelines apply to all the projects that are subsidized by Bureau Metamorfoze. The preservation masters provided in this context must be of such a quality and measurable relationship to the original, that they can in fact replace it. This means that all the information visible in the original must also be visible in the preservation master; the information transfer must be complete since the original is threatened by autonomous decay and will no longer be used once it has been digitalized.

History

Metamorfoze, the national program for preserving the paper heritage, is a joint venture between the National Library of the Netherlands (Koninklijke Bibliotheek or KB) and the National Archives. The program is the joint initiative of the Ministry of Education, Culture and Science and is being coordinated by Bureau Metamorfoze.

The program focuses on the preservation of documents, books, newspapers and periodicals from the period 1840-1950 that are endangered by paper acidification.

The first method chosen is to preserve the information by capturing the content of the documents on microfilm and since 2007 the originals are being digitized. The capture, the microfilming and the digitizing, is carried out according to Metamorfoze Preservation Microfilming Guidelines and Metamorfoze Preservation Imaging Guidelines. In addition, the original documents are securely packaged and stored and withdrawn from use.

At the start of the program in 1997, microfilming quality standards were developed to ensure optimum quality of the microfilms produced as part of the program. These standards were in keeping with the international standards for *preservation microfilming* in place at the time. During the years of practice with the Metamorfoze program, the Metamorfoze microfilming guidelines have been repeatedly adjusted in detail and some sections have been elaborated. In 2006 the two latest versions of the Metamorfoze Preservation Microfilming Guidelines were published. These guidelines are primarily focused on correct exposure and correct tonal capture for the whole gray scale.

This approach, this focus on correct exposure and correct tonal capture, is implemented in the Metamorfoze Preservation Imaging guidelines as well, and is regarded as the most important aspect of the Metamorfoze Preservation Imaging Guidelines.

Version 1.0

This new version of the Metamorfoze Preservation Imaging Guidelines follows the Metamorfoze Preservation Imaging Guidelines, Test version 0.8, July 2010. The first draft version of the Metamorfoze Preservation Imaging Guidelines was published in 2007.

Version 1.0 contains a lot of technical information and some technical improvements, like:

- The tolerance values for white balance, correct exposure, gain modulation and uniform illumination are described in ΔL^*, ΔC^*, ΔE^* values and in 8 bit count values. This means that this version can be used with different software packages, like UTT software and Photoshop. And the neutrals of different test charts can be used as well, like Digital Color Checker SG, the mini Color Checker, UTT and the Q-13.
- For working with a UTT according to quality level Metamorfoze and Metamorfoze Light it is required to use a UTT L*a*b* reference file for analyzing the white balance, correct exposure and gain modulation. This means a more accurate tonal capture.
- The tolerance level for color accuracy in quality level Metamorfoze Light and Extra Light is increased, from Mean $\Delta E < 12$ and max $\Delta E < 25$ into Mean $\Delta E \leq 5$ and max $\Delta E \leq 18$.

Some changes in the workflow are made in quality level Metamorfoze Extra Light for mass digitization of books and newspapers, like:

- In Metamorfoze Extra Light it is permitted, after special agreement, to digitize bitonal books and newspapers in gray scale (gray gamma 2.2).
- In Metamorfoze Extra Light it is no longer required to digitize small technical targets, like the Q-13 and mini color checker, with the originals.

With these new options the Metamorfoze Preservation Imaging Guidelines can be used for all different types of (mass) digitization projects.

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Differences between version 0.8 and version 1.0

	version 0.8	Version 1.0
Quality levels	Metamorfoze, Metamorfoze Light, Metamorfoze Extra Light	Metamorfoze, Metamorfoze Light, Metamorfoze Extra Light
Tonal capture is analyzed up to	Metamorfoze L*3, Light & Extra Light L*20	Metamorfoze L*3, Light & Extra Light L*20
Color space	Metamorfoze & Light eciRGBv2, Extra Light eciRGBv2, Adobe RGB (1998)	Metamorfoze eciRGBv2, Light eciRGBv2, Adobe RGB (1998), Extra Light eciRGBv2, Adobe RGB (1998), Gray Gamma 2.2
White Balance	ΔC* 2	ΔC* 2
Correct exposure	ΔL* 2	ΔL* 2
Gain modulation	Formula based on ΔL* values	Formula based on ΔL* values and additional on 8 bit count values (Y signal)
Gain modulation in the high light area	80% - 108%	80% - 108%
Gain modulation in the other parts of the gray	Metamorfoze & Light 60% - 140%, Extra Light 10% - 200%	Metamorfoze & Light 60% - 140%, Extra Light 10% - 200%
STD	Channel is not described. 16 bit ≤ 1024, 8 bit ≤ 4	Applied to luminance channel. 16 bit ≤ 1024, 8 bit ≤ 4
Uniform illumination	≤ DIN A3 ΔL*3 ≤ DIN A2 ΔL*4 ≤ DIN A1 ΔL*6 ≤ DIN A0 ΔL*7	≤ DIN A3 ΔL*3 ≤ DIN A2 ΔL*4 ≤ DIN A1 ΔL*5 ≤ DIN A0 ΔL*6
Color accuracy, CIE 1976, DCSG	Metamorfoze Mean ΔE* ≤ 4 Max ΔE* ≤ 10 Light & Extra Light Mean ΔE* ≤ 12 Max ΔE* ≤ 25	Metamorfoze Mean ΔE* ≤ 4 Max ΔE* ≤ 10 Light & Extra Light Mean ΔE* ≤ 5 Max ΔE* ≤ 18
Sampling efficiency	≥ 85% applied to the three RGB channels	≥ 85% applied to the luminance channel
MTF50	Not described	Metamorfoze ≥ 2,5 lp/mm, Light & Extra Light ≥ 2,25 lp/mm
Sharpening, max modulation	≤ 1,05	≤ 1,05
Geometric distortion	≤ 2%	≤ 2%
Difference between claimed & obtained sampling rate	≤ 2%	≤ 2%
Color mis-registration	+/- 0,50	Metamorfoze ≤ 0,35 pixel Light & Extra Light ≤ 0,50 pixel
Artifacts	Not allowed	Not allowed

The Metamorfoze Guidelines attract much national and international attention, from the cultural and heritage sectors as well from the manufacturing industry (suppliers, manufacturers of cameras and scanners), and from national and international standard organizations like ISO and in the Netherlands NEN. The Metamorfoze Guidelines are used at an international level. To ensure that these guidelines can be used as widely as possible, an appendix has been provided to give the Metamorfoze exposure tolerances for ProPhoto RGB and the technical targets that are developed in the United States, such as the Device Level Target (DLT) and the Object Level Target (OLT).

Knowledge and skill requirements and UTT

In 2007, In 2007, in the first draft version of the Metamorfoze imaging guidelines is stated: To be able to apply these *Guidelines*, a certain level of knowledge is required. Knowledge and skills required are: Basic knowledge of sensitometry and of certain basic concepts of photography. Such as density, pixel value, OECF, dynamic range, MTF measurement, resolution, lp/mm etc.

Right now, in 2012, all these requirements are still needed. The world however changed a little bit for the better. Some camera and scanner manufactures, like Hasselblad, Zeutschel and i2S, are using the Metamorfoze Preservation Imaging Guidelines, or some parts of it, as input to construct and calibrate their devices with. And sometimes extra tools are placed in the software to make it easier to calibrate or adjust a device according to the guidelines for the operators or photographers. These manufactures also offer special technical support to calibrate their system according to the Metamorfoze guidelines. This improves the daily practice of the Metamorfoze imaging work flow.

However technical knowledge and understanding is needed to be able to work according to the guidelines. Even if a system is perfectly calibrated according to the guidelines it is possible that now and then a tolerance level is not precisely met. The guidelines are very strict and tight. So during the day, while digitizing a collecting a small error might appear, such as a sampling

efficiency failure of 1 % in the vertical direction in the left corner at the bottom of the image frame. Instead of the required percentage of a minimum 85% the sampling efficiency on this spot is 84%. Then the question arises what to do next. It needs skills to judge and to interpret the error. Does the system has to be recalibrated and has there to be made some rescans or new images? Or is the error so small that there is no need to worry and to stop the digitizing? A big step is made in the UTT software to cope with this issue. An extra quality level is placed in the UTT software. This extra level is saying: Please note that this or that criteria is out of the specs, the overall technical quality is or might still be okay, but watch out and take action or consider to take action to solve this error. So this extra layer can be seen as a warning signal between "the technical quality is in the specs" and "the technical quality is out of the specs which absolutely means rescan and recalibration". It is the traffic light approach. The red light means "stop", the green light means "drive" and the yellow or orange light is a warning level in between, to indicate to start driving or to start stopping. In the UTT software the extra level is colored yellow.

The tolerances per image criteria of this yellow level can be tuned freely. The idea is to set the tolerances on a specific level depending on the type of originals that are being digitized. Some originals are more valuable then others and some originals carry more information in the high light area then in the darker areas. So depending on the appearance and type of the originals this extra level can be set before the digitizing is started. And before the start of a digitization project agreement is needed between client and vendor about the use and settings of the extra yellow level.

Working with UTT according to quality level Metamorfoze and Metamorfoze Light has to be carried out with a mounted UTT and with a UTT L*a*b* reference file. The measured L*a*b* values of the technical test charts can and will in most cases slightly deviate from the theoretical L*a*b* values, which is why departing from the real L*a*b* values is more accurate.

In a UTT DIN A3 there are 4 gray scales mounted. To calibrate and to judge the tonal capture performance of a system 1 of these 4 gray scales has to be examined first, and that is the lower horizontal one. The color patches of a UTT are not meant for color profiling. But for monitoring the stability of the color capture performance of a camera or scanner during the digitization. Color shifts expressed in delta L*, C* and E* can be detected. Color profiling at the moment is carried out with help of a DCSG and may be in the future with an IT8 target. Also the Metamorfoze tolerances for color accuracy at the moment are based on the performance of a DCSG. And may be in the future the IT8 target will be used for specifying the color accuracy tolerances instead. Using the neutrals and color patches of different test charts might cause confusion. In a few months a Metamorfoze and UTT article will be published with information about the specific use and hierarchy of different test charts.

Metamorfoze and standard movement

Over the last few years there has been a growing international interest and adoption of the Metamorfoze guidelines or parts of the guidelines by museums, libraries and archives from the Netherlands, UK, VS, Russia, Finland, Sweden, Czech Republic, Spain, Indonesia, Australia and Belgium. In the international librarian, archival and museum community there are at the moment two imaging guidelines available, the Metamorfoze Preservation Imaging Guidelines of the KB and the Technical Guidelines for Digitizing Cultural Heritage Materials of the Federal Agencies Digitization Initiative (FADGI) - Still Image Working Group. Last year a movement started with the intention to start a research to produce and to construct an ISO imaging standard based or partly based on these two excising guidelines. This movement started at the IS&T Archival conference in Salt lake City last year and was initiated by Dietmar Wueller from Image Engineering. A few months later ISOTC42 working group 26 was launched to fulfill this purpose. Earlier this year there has been a ISOTC42 WG26 meeting. In the Netherlands has a similar standard movement started as well. This movement has the same intention, to produce an imaging standard. In the Netherlands, at the office of NEN (Dutch national body of standards) has been one meeting earlier this year as well. These movements have just started and are very interesting.

I'm happy to notice a growing international interest in standards like the Metamorfoze guidelines or parts of these guidelines by camera and scanner manufactures and by the librarian, archival and museum community. I like the standard movements as well and I'm happy to join ISOTC42 / WG 26 and the NEN working group.

Metamorfoze Preservation Imaging Guidelines and the future

The use of the Universal Test Target (UTT) is focused exclusively on monitoring the technical quality on a daily base during the digitizing process. In order to use the UTT for monitoring the stability of the color accuracy of a system (entire combination of light, lens and camera or scanner with a specific color correction profile) a new L*a*b* reference file of the UTT color patches is required. This reference file is bound to the specific UTT and the specific entire camera or scanner system. More documents about working with the UTT according to the Metamorfoze Guidelines are expected to be available in 2012.

Some scanners provide a better color accuracy performance when it comes to light paper hues (pale yellow and pale brown) provided the color profile is prepared with an IT8 chart instead of a Digital ColorChecker SG. In the future making a color correction profile with an IT8 chart will be studied in detail.

The color accuracy tolerance is currently described in the Metamorfoze guidelines by giving an average and maximum delta E value calculated with CIE 1976 and is based on a performance of the ColorChecker SG. The color accuracy may only be assessed provided all the neutrals, the entire gray scale, meets the tolerances set in the Metamorfoze guidelines for the white balance, the exposure and gain modulation. Therefore, a better description of color accuracy is being prepared. In this finely tuned description, after assessing the neutrals properly, the near neutrals will be assessed first. Then the more saturated colors will be assessed. The IT8 chart is used for this study.

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