

Metamorfoze Preservation Imaging Guidelines, Version 2.0

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Abstract

Since its publication in 2012, the Metamorfoze guidelines are used and adopted worldwide by the cultural heritage community and by camera & scanner manufactures. In 2017, ISO/TS 19264-1 is published. This ISO technical specification is based on the unification of the Metamorfoze and FADGI guidelines and on new technical insights. ISO/TS 19264-1 provides universally agreed upon terms, units and methodology for cultural heritage imaging.

Version 2.0 of the Metamorfoze Preservation Imaging Guidelines is under construction now. And a draft version is published.

Metamorfoze

Metamorfoze is the Dutch national programme for the preservation of printed heritage. The programme is an initiative of the Ministry of Education, Culture and Science. The Metamorfoze programme was started in 1997 and is a programme operated by KB, National Library of the Netherlands.

Purpose of the Metamorfoze Preservation Imaging Guidelines

The Metamorfoze Preservation Imaging Guidelines relate solely to the image quality of a raw first-generation camera or scanner file. The file format of this first-generation file must be a TIFF uncompressed group 6 file or a JPEG2000 file. These file formats are not specified further in this document. This first-generation file must contain an embedded colour space like *eciRGBv2* or Adobe RGB (1998). This first-generation file is referred to as the preservation master.

The quality of preservation masters and their objectively measurable relationship to the originals must be such that they can be used as a replacement for the original material. The description “quality such” is used to indicate that all the information that is visible in the original must also be visible in the preservation master, so the transfer of information must be complete since originals are subject to autonomous decay and will be withdrawn from use after they have been digitized.

Various technical criteria and tolerances are referred to in the Metamorfoze Preservation Imaging Guidelines. The technical quality of the preservation master can be objectively assessed based on these criteria and tolerances. That objective assessment will be carried out with the help of technical targets and software. Besides the method of objective assessment, a preservation master must also always be subjected to a visual check for completeness and artefacts.

Draft version 2.0

This draft version has been published in order to provide an insight into all the new technical criteria and tolerances. This publication makes it possible for anyone to test and evaluate all

the new technical criteria and tolerances. The complete definitive version will be published at the end of 2019.

New elements

Names of the three different quality levels: Metamorfoze Full, Metamorfoze Light & Metamorfoze Extra Light.

The formula $CIE2000SL=1$ is used to measure & to specify: tone reproduction (ΔL), gain modulation, colour accuracy (ΔE) & illumination non-uniformity (ΔL).

The formula $CIE2000 \Delta E$ without luminance (ΔL), is used to measure & to specify white balance (ΔE_{ab}).

Noise level: Noise is measured & specified in the luminance channel of the L axis of the CIELAB colour space.

The technical test targets Kodak Gray Scale Q-13 and the Mini Color Checker will no longer be used in the Metamorfoze work flow. These targets will be replaced by the Munsell Linear Gray Scale.

To calibrate a scanner or camera and to analyse the performance of a scanner or a camera it is recommended to use technical targets with their specific Lab reference files.

The black background to place the originals on has to have an L^* value around 20.

All the elements that are not specified in this draft version, such as the assessment of illumination, the use of technical test charts and exposure tables, for example, remain unchanged. Version 1.0 is leading for all these elements.

Metamorfoze Full, Metamorfoze Light & Metamorfoze Extra Light

The first quality level now has a meaningful name. This has been done in order to enable a clear distinction between the different levels of quality. All three of the quality levels assure information retention. Metamorfoze Full was developed for the digitization of two-dimensional material for which a high level of colour accuracy is desirable. Metamorfoze Light and Metamorfoze Extra Light have been specifically developed for digitization and mass digitization of manuscripts, archives, books, newspapers and magazines.

Formula $CIE2000SL=1$

In this version 2.0, we use the $CIE2000SL=1$ formula to calculate and describe the tolerances for correct exposure, gain modulation, illumination and colour accuracy.

The $CIE2000$ formula is based on the perception of the human eye. The benefit of this is that the basic principle of the Metamorfoze guidelines – “What you see is what you get” – is now even better substantiated in technical terms. The potential drawback is that working with the $CIE2000SL=1$ formula is slightly more complicated in technical terms than working with $CIE1976$. Working in accordance with the Metamorfoze guidelines now requires slightly more technical insight and understanding, particularly for assessing the white balance.

CIE2000 contains so-called visually weighted elements in order to replicate the perception of the human eye. The addition of $SL=1$ to the CIE2000 formula means that no visually weighted elements are used to calculate the exposure (ΔL) and instead, a shift in luminance is calculated purely mathematically. This is essential for assessing exposure (ΔL), gain modulation and illumination correctly.

Using the CIE2000 $SL=1$ formula, exposure, gain modulation and illumination are assessed in the same way as they are when using the CIE 1976 formula. Therefore the tolerance values of these technical criteria have not been adjusted.

White balance, $\Delta E_{ab} \leq 3$

The human eye is more sensitive to a shift from white to red or green (shift on the a-axis from the CIELAB colour space, to +a or to -a) than to a shift from white to yellow or blue (shift on the b-axis from the CIELAB colour space, to +b or to -b). The CIE2000 formula is based on the working of the human eye and therefore, using this formula, a shift from white to red or green will be assessed more strictly than a shift from white to yellow or blue.

This means that when using the CIE2000 formula, it is no longer possible to specify the tolerance for a shift from white on the a-axis and on the b-axis with the same margins. In other words, the familiar tolerance value for specifying the acceptable shift in white balance $\Delta C \leq 2$ can no longer be used with the CIE2000 formula.

In version 1.0, a hue shift (ΔH) in the neutrals is not assessed for the purpose of assessing the white balance. For the hue of the colour shift makes no difference to the value when using the CIE1976 formula. When using the CIE2000 formula a shift on the a-axis is assessed more strictly than a shift on the b-axis, therefore a hue shift (ΔH) also plays a significant role, in addition to a colour shift (ΔC).

It is therefore important to specify the white balance with a combined shift in colour (ΔC) and hue (ΔH). The white balance is now referred to as ΔE_{ab} . In ΔE_{ab} , the shift in luminance (ΔL), is not calculated. The new tolerance value for the white balance is $\Delta E_{ab} \leq 3$. This value applies to Metamorfoze Full, Metamorfoze Light and Metamorfoze Extra Light. This new tolerance level is based on research carried out in cooperation with ISO group TC42 JWG26.

Colour Accuracy

The CIE2000 $SL=1$ formula is used to assess the colour accuracy according to the perception of the human eye. As a result, the assessment, like the average and maximum Delta E values, will be different to the assessment carried out using the CIE1976 formula. Generally, the Delta E values obtained will be lower. However, it was decided not to adjust the tolerance values for the specification of colour accuracy. Tolerance values using the DCSG colour chart: Metamorfoze Full: Mean $\Delta E \leq 4$, Max $\Delta E \leq 10$. Metamorfoze Light & Metamorfoze Extra Light: Mean $\Delta E \leq 5$, Max $\Delta E \leq 15$.

Noise level $\leq 1,6$

The noise level is specified, measured and assessed in the luminance channel on the L^* axis from the CIELAB space. The new tolerance value for noise is less than or equal to 1.6. This number is based on 1.56% as specified in version 1.0 of the guidelines. This value corresponds to the 8 bit tolerance value of 4, and the 16 bit tolerance value of 1024 as described in version 1.0 of the Metamorfoze guidelines.

Munsell Linear Gray Scale

The Munsell Linear Gray Scale replaces the Kodak Gray Scale and the Mini ColorChecker. The Kodak Gray Scale is not spectrally neutral. For that reason, this test chart was only used in conjunction with the mini ColorChecker in version 1.0 of the guidelines. The Munsell Linear Gray Scale is spectrally neutral. Therefore it can be used without the mini ColorChecker. In addition, the Munsell Linear Gray Scale, just like the neutrals from the UTT, is also substantiated by L^* . The L^* differences between the individual grey patches are always five L^* values, just like between the grey patches of the neutrals from a UTT.

Technical targets with Lab reference files

The real $L^*a^*b^*$ values from technical test charts may differ from the theoretical $L^*a^*b^*$ values. It is therefore advisable to always take the real $L^*a^*b^*$ values as a basis. This applies both when calibrating a system (camera or scanner) and assessing the technical performance of a system as well as when setting up a QC & QA work flow. Technical test charts which are frequently used are subject to wear and they may also become slightly discoloured due to the influences of light. For that reason, it makes sense to provide technical charts with a new LAB reference file every year. A UTT test chart should always be used with its unique Lab reference file.

Black background

To prevent clipping in black, the black background (made of paper or textile, for example) on which the technical test charts or originals are placed for digitization must have a L^* value of $\approx L^* 20$ (between $L^* 15$ and $L^* 25$). As a result, definition remains on the black, and artefacts will be easier to see and there will be a clear distinction between the edge of the original and the background.

Additional remarks

Assessment in the centre of the frame or across the whole frame

Due to the illumination tolerances and the format of the frame, the performance of the exposure, gain modulation and colour accuracy in the frame may differ in nature. Therefore for the exposure, gain modulation and colour accuracy tolerances it is specified that these criteria should be assessed in the centre of the frame. In addition, these criteria are assessed across the whole frame. Measurements are carried out across the whole frame for performance of all the other image criteria. It is advisable to measure and assess the performance of the white balance across the whole frame. The neutrals of a frame-filling UTT can be used for this purpose.

Advice on the use of technical test charts

Use technical test charts in accordance with a fixed hierarchical structure with the following three objectives: Calibration, validation and the setting up of a periodic quality control and quality assurance (QC & QA for short) workflow.

Various test charts can be used for the calibration of systems in accordance with the Metamorfoze guidelines. The day targets as specified in chapter 3 of version 1.0 are used for validation of systems in accordance with the Metamorfoze guidelines. It should be pointed out here that the Kodak Gray Scale and mini ColorChecker may be replaced by the Munsell Linear Gray Scale. Following the approval of a system, a UTT can be used on a daily basis for setting up a periodic QC & QA work flow for (mass) digitization projects. The UTT test chart has been specially designed for this purpose.

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References

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- [3] Metamorfoze Preservation Imaging Guidelines, https://www.metamorfoze.nl/sites/metamorfoze.nl/files/publicatie_documenten/Metamorfoze_Preservation_Imaging_Guidelines_1.0.pdf
- [4] Universal Test Target, UTT, www.universaltesttarget.com.
- [5] FADGI Guidelines, Federal Agencies Digitization Guidelines
- [6] ISO, International Organization for Standardization, www.iso.org.

Author Biography

Hans van Dormolen is the founder of Hans van Dormolen Imaging & Preservation Imaging (HIP). He is working as an independent imaging consultant in the cultural heritage community. He was working as a researcher at the KB, the National Library of the Netherlands. He is the author of the Metamorfoze Preservation Imaging Guidelines and author and co-author of several other Metamorfoze guidelines. Hans is a member of ISO TC42 JWG26, IS&T and AHFAP. He received an IS&T Service Award for his work in objective capture practices for cultural heritage imaging in 2014.