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Workshop *Hands On* Preservation Microfilming, Lisbon, February 2006

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INTRODUCTION

On February 23 and 24 of 2006, a Workshop on Preservation Microfilming was held at the National Library of Portugal in Lisbon. The workshop was set up as a joint initiative of the Biblioteca Nacional (Lisbon) and the Koninklijke Bibliotheek (The Hague), and carried out under the umbrella of LIBER Preservation Division and with the sponsorship of Scan System, a Portuguese microfilm/scan company, the only commercial party involved. The Workshop aimed to raise awareness about technical issues that can affect the quality of microfilms. Since the meeting was set up as a workshop, the number of attendants was limited to 15 in order to guarantee a *hands on* approach. The participants consisted of people working for the national libraries and several archives of Portugal and Spain. Scan System, Hans van Dormolen, Quality Manager Microfilming of Metamorfoze, the national preservation program of the Netherlands, led the Workshop.

For some time, the idea of organizing a hands on workshop was discussed at divisional meetings. The annual conference never seemed the appropriate place for such a workshop. The Liber 34th Annual Conference 2005 in Groningen, the Netherlands (July 2005) proved to be a turning point; at that occasion, Hans van Dormolen presented a paper raising very serious issues about the quality of preservation microfilms that are being produced. The technical issues he tackled are a matter of concern to every unit involved in microfilming. His paper raised enough interest to put the workshop on the move. Since the LIBER Preservation Division has been trying to involve colleagues from Portugal and Spain in LIBER activities for some time, the decision was made to grasp the opportunity and to organize the workshop in the South of Europe.

SENSITOMETRY

Hans van Dormolen: “In the two-day workshop, I focused mainly on sensitometry. Sensitometry is a photographic science, which studies the relationship between light, contrast, density and the development of a film. At the basis of this science lies the so-called ‘S-curve’. This S-curve provides information about D-max (maximum density), D-min (minimum density); these values can be read from the shape and angle of inclination of the curve. The bigger the angle of inclination, the higher the contrast. Higher contrast implies that a greater number of grey tones are lost. Loss of grey tones means partial or complete loss of poorly printed and/or handwritten characters, like the greyish coloured and faded characters in old newspapers and manuscripts.

In my opinion, one cannot work in the field of preservation microfilming without having a full understanding of the S-curve, and the way the S-curve changes - or might change - over different generations of film or scanned images from a film. The changes are mostly changes for the worse: a higher contrast, which means loss of information. If one knows exactly what causes these changes, one is able to predict the changes and even to aim for changes for the better: lower contrast. The type of film, the type of developer, the thinning of the developer, the developing speed and temperature, these are all determining factors for the shape and the angle of inclination of the S-curve. The difference in contrast between the original and the image on a film depends on the angle of inclination. We need the angle of inclination to calculate the gamma value; the gamma value is the tangent of the angle. More convenient (much easier and a lot quicker) is calculating the gamma by using a *Kodak Gray Scale Q-13* or *Q-14* (Dormolen, 2004, p.22-24). A good way of improving one’s knowledge of the S-curve and its behaviour is to make an exposure of a *Kodak Gray Scale* on every preservation microfilm at both the beginning and end. The next step: calculate the gamma value and measure the D-max and D-min at the beginning and end of each developed microfilm, and compare the results over a given period of time.

Without an exposure of a *Kodak Gray Scale* on a first generation preservation microfilm, we are not able to calculate the gamma value and have no information whatsoever about the shape of the S-curve. Consequently, we are totally in the dark about the amount of loss regarding the visible grey tones in the original and what is left of the grey tones in the first generation microfilm - and in all the following generations. This means we cannot judge whether a preservation microfilm has been scanned, duplicated or even developed in the right

way. If serious questions on the developing quality of the film and the monitoring of that quality over different generations can not be answered, I would say that the term 'Preservation Microfilm' can not be applied to such a film. I can't stress this enough: a microfilm without a *Kodak Gray Scale* isn't a preservation microfilm at all.

A focus on maintaining all the grey tones (low contrast) seems to clash with a focus on legibility (a little more resolution and contrast). The human eye likes contrast for reading, but the contrast in a microfilm developed according to standard procedures is 3 times as great as the contrast in the original. The third generation can have a contrast, which is 12 times as great. The loss of poorly printed and handwritten characters and all sorts of greyish information is overwhelming in such a huge contrast. A key question that rose during the workshop is: exactly how good are the high contrast preservation microfilms that are being produced worldwide? And how much of their cultural heritage do people using third generation microfilms and microfiches actually get to see in the reading rooms? These questions are hard to answer, especially when you realize that microfilms have been produced for over 60 years now. People in reading rooms, however, are often faced with an image that consists of only 5 or 8% of the original grey tones - sometimes even less. This means that around 92 to 95% (or even more) of the grey tones is lost. A dramatic loss, which cannot be undone. Since the S-curve also plays a crucial part in the quality of a digital image, we have to be on our guard. We must learn from our mistakes and prevent them from happening over and over again. Before we step into the world of *preservation scanning* we have to do a lot of research. We have to write guidelines to ensure we won't be repeating the mistake we made with analog reformatting.

We can not possibly judge the advantages and disadvantages of the Computer Output Microfilm device by Zeutschel, the OP-500, without a good understanding of sensitometry. The main question with respect to this device, is: what happens to the S-curve travelling from the original to the digital image and then finally ending up on an analog film, which is developed in high- or low-contrast? Working with this OP-500 could make up for the shortcomings of analog high contrast film development by means of a digital manipulation of the digital image's S-curve. But there will be loss in the tonal range when using this approach. So again, I would advise to expose a Kodak Gray Scale and scan a Kodak Gray Scale and compare both the analog and the digital version. Next, these results can be compared to the result of a digital/analog work flow like the OP-500.

I do not think solving analog problems by digital means is recommendable. Yet, on the other hand, the quality of the originals is a determining factor. What is the tonal range of the originals and what part or parts of this tonal information will be lost in high contrast microfilming and by an OP-500 work flow with digital S-curve manipulation? The guidelines for preservation scanning pose yet another problem: are there any reliable and useable guidelines in existence? Again, I would like to emphasize that we have to do more research and cooperate to solve all these reformatting questions.

Producing preservation microfilms from a sensitometric point of view paves the way for a more reliable and predictable workflow. Not only is it possible to calculate the loss of grey tones in different generations, it is also possible to calculate the exact required shutter speed or the required amount of light to ensure the image on the film is within the required density range. The required density range is located in the linear part of the S-curve. This implies that the result (measured in density on a film) of a change in shutter speed or amount of light is predictable. In turn, this means that the result (measured in density on a film) of a change in density of the paper-based original is predictable and also easy to calculate. When microfilming old newspapers or any other original material affected by old age or deterioration, this saves a lot of time and speculation.

I'll give you a practical example: suppose the difference in the measured density within a single page of old newspaper is 0.14 points in density and the microfilm that I'm going to use is high contrast. The required density range for high-contrast is 1.00-1.30. High contrast implies a contrast, which is 3 times greater than the one in the original. So a difference in density in the original of 0.14 points will result in a difference of 3 x 0.14 = 0.42 points in the high-contrast microfilm. This difference is too big, given the required density range of 1.00-1.30. A widely accepted strategy is to make the exposure twice, each with a difference in shutter speed or amount of light. In my opinion, however, it makes more sense to lower the contrast. Suppose the contrast of the microfilm is not high-contrast but low-contrast. Low-contrast means a contrast 1.5 times as great as in the original. So the given difference in density of 0.14 points will result in a difference of 1.5 x 0.14 = 0.21 points in the low-contrast microfilm.

Several things follow from this: first, a low-contrast film is better equipped to cope with differences in the density of the originals than a high-contrast microfilm. Secondly, a low contrast microfilm will present a more equal range of density. This means that this film is easy to scan from and duplicate. Thirdly, it is easier for a camera operator to produce a low-contrast preservation microfilm within the required density range than a high-contrast preservation microfilm. Fourthly, working with density readings of the original to ensure the required shutter speed or amount of light is maintained, is a method that provides more detailed information and is much more adequate than the commonly used reflection light measurement tool. Finally, working with

low-contrast microfilms and density readings of the originals makes it possible to narrow the required density range down from 1.00-1.30 high-contrast to 1.00-1.20 low-contrast.

Of course, this approach requires lots of photographic skills and daily effort. The microfilm cameras needs to be calibrated and the daily calibration of the developing machine is much more time consuming, not only with respect to the D-max, but regarding the D-min and gamma as well. Also, the density of a film behaves in a less linear way as I described above, and of course it isn't possible to calibrate the developing machine daily on the exact same density and gamma value. Small margins have to be included in the process, little imperfections have to be accepted. The size of the margins and number of imperfections depend on the quality of the devices, the used materials and the skills and objectives of the operators. In the beginning, it will all be very time consuming. But in the end, the pay off will be tremendous: a clear and well-based work flow, and high quality preservation microfilms."

Maria Luísa Cabral: "Far more than mere technical issues, the core question raised about the gamma value links directly to the quality of the microfilm, which libraries and archives keep claiming is very reliable. Indeed, in order to reach such a level of performance, the microfilm production will have to take aspects related to sensitometry into serious consideration. What we are dealing with is much more than just a technical issue: we are faced with a management issue concerning the safeguarding of our memory and cultural heritage. It is time, then, to review our procedures, our priorities and our goals. As a matter of fact, to put our *hands on.*"

In order to exchange technical solutions and share knowledge on a national level in Portugal and Spain, a discussion group will be established on the internet. The discussion group will be the initiative and responsibility of Biblioteca Nacional.

More information about the gamma and the Preservation Microfilming Guidelines can be found on the Metamorfoze website.

Technical thumb rules for producing preservation microfilms.

- Always use a planetary camera.
- Density measurement: measure the density of a film with a daily-calibrated projection densitometer type HE 610. For calibration, use the 'Metamorfoze calibration strip' with a calibration point of density 1.11. Check the imperfections of the projection densitometer afterwards by measuring the density from 0.05 up to 2.00. This can be done once every 6 months or more frequently if necessary.
- Illumination: at the beginning of each film, make an exposure of a clean white sheet of paper with the reduction ratio used for filming the originals. The size of the paper must be frame filling for reduction ratio 22. The next step is to measure the density of this exposure in the middle and in the corners. The difference in density between the measured points must not exceed 0.15 points. Even better is not allowing an exceed above 0.10 points.
- Density: measure the D-max and D-min at the beginning and end of each film with the help of patch A and patch 19 on a *Kodak Gray Scale*. This is necessary to check the stability and regeneration of the developer. Compensate a drop in density by adding fresh developer and removing old developer, not by changing the developing speed or temperature. Develop with a developing speed of 2 or 2.5 when using an Agfa FP-500 developing machine.
- Gamma: calculate the gamma at the beginning and end of each film with the help of patch A and patch 2 or patch 3 on a *Kodak Gray Scale*.
- Resolution: check the resolution at the beginning and end of each film with the help of 5 Resolution test charts number 2. Place one chart in the middle of the frame and the others in the corners. Always add a ruler in the middle of this exposure, a little above the resolution test chart. A *Kodak Gray Scale* can be placed under this resolution test chart. Always add the used reduction ratio to this image as well.
- Density: measure the density of the originals between the lines on the background. Use a density range of 1.00 - 1.30. If a bigger range is needed, drop a little in density towards 0.95 – 1.30. Make an exposure twice if a bigger range is still needed.
- Methylene-Blue test: use the Agfa Structurix thiotest for measuring the amount of thiosulfate. Allow no colouring whatsoever. Check a few films at random during the week.

REFERENCES

Dormolen, Hans van. *Metamorfoze Preservation Microfilming Guidelines*. Den Haag : Bureau Metamorfoze, March 2004. http://www.metamorfoze.nl/publicaties/richtlijnen/english/guidelines.pdf

WEB SITES REFERRED TO IN THE TEXT

Biblioteca Nacional. http://www.bn.pt/

Koninklijke Bibliotheek, National library of the Netherlands. http://www.kb.nl/index-en.html

LIBER Preservation Division. http://www.kb.dk/liber/division/preserv/

Metamorfoze. http://www.metamorfoze.nl/

OP-500. http://www.zeutschel.de/produkte/op500.html

Scan System. http://www.scansystem.com/