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Published online: 27 Sep 2019.

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ABSTRACT

Many museums and collections publish digital photographs or scans of objects held in their collections in online-accessible databases. What are the epistemological issues at stake when an analogue object is digitised with the aim to 'illustrate', 'document' or 'represent' its analogue original? This essay tackles the question based on practical, hands-on experiences that the author obtained through testing a method for digitising lantern slides. The digital copies achieved in digitisation projects, the author argues, are never a matter of mere documentation that produce 'evidence' about or 'neutral/objective copies' of the analogue objects but are results of interpretation, selection processes and modelling, informed by the aim of the digitisation project and the perspective of the person carrying out the work. As a case study, this article provides a material basis for theoretical, conceptual and epistemological reflections on the relation of analogue and digitised (media) objects, adding to current digital humanities discussions on tool criticism and source critique of digital objects.

The process of digitising objects held in collections and making the digital objects available online is part and parcel of the activities of cultural heritage institutions in 2019. Every digitisation project needs to make explicit decisions on database software and metadata (and how to structure it) as well as legal and sometimes ethical questions on how and what to make available online. However, decisions about how analogue objects are digitised are not always documented. There are, of course, a number of best practice handbooks detailing workflows, guidelines for digitisation for specific materials and manuals for 2D and 3D scanners and their corresponding software (Collections Trust 2019).[1] Collection management software such as 'Spectrum' allows for documentation of conservation and restoration decisions concerning the physical object in the record. Perhaps surprisingly, then, this detail of decision-making and process-documentation concerning analogue objects is not always adopted during digitisation projects, and certainly not when the digitisation does not concern (the restoration of) masterpieces within art collections.[2] With the exception of images taken for restoration activities, or for documenting the state of an object before it is loaned out, the *aims* of creating digital images are seldom made explicit. It is rare that information on the way in which a digital image was captured – let alone an explanation of the reasons why this specific method was chosen over others – is documented in the publicly visible part of online

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databases of cultural heritage. However, this is relevant information for source critique, as scholars in the emerging field of tool criticism within digital humanities argue (de Leeuw and van Gorp 2019; Koolen, van Gorp, and van Ossenbruggen 2019).

In this article, I wish to contribute to the debate on digital tool criticism and digital source critique by reflecting on the implications of different ways in which a digital copy of a lantern slide is achieved. I am taking the position of a media historian, emphasizing epistemological questions over details on data formats and data processing. During my work for the project 'A Million Pictures – Magic Lantern Slides as Artefacts in the Common European History of Learning (2015–2018)'[3] (hereafter AMP), part of my task was to test a method to digitise lantern slides and to add records with digital images to the 'Lucerna Magic Lantern Web Resource'[4] (hereafter Lucerna). I will come back to the experiences I gained while experimenting with appropriate modes of digitisation throughout this essay, and put my findings up for discussion. Such reflections, I believe, are helpful for the conceptualisation of future digitisation projects (not only of lantern slides) and should be considered in cooperative projects between academic researchers and collections managers or curators.

After a short introduction to key points of digital tool criticism, I will present several digital images that I found in the online presentation of lantern slides, mainly from Europeana, the European Union's online platform for digitised cultural heritage collections.[5] In the second section, I will present my own practice as a case study followed by a call to document the aims and methods of digitisation projects for research on digital materials.

Digital tool criticism

Proponents of digital tool criticism stress the need for scholars to be aware of the implications and limitations of methods and tools that they employ in all steps of the research process that use digital environments or digital tools. All too often, they observe, researchers do not sufficiently reflect on the structure of a digital environment or portal, on a specific application to process, analyse and visualise data, or on the methods by which statistical outputs are created. Digital tool criticism should help to make scholars aware of bias and/or limitation in digitally supported research steps, from defining their research question to building their corpora to analysing and publishing the data. As Koolen, van Gorp, and van Ossenbruggen (2019) argue,

> [w]ith digital tool criticism we mean the reflection on the role of digital tools in the research methodology and the evaluation of the suitability of a given digital tool for a specific research goal. The aim is to understand the impact of any limitation of the tool on the specific goal, not to improve a tool's performance. That is, ensuring as a scholar to be aware of the impact of a tool on research design, methods, interpretations and outcomes. (Koolen, van Gorp, and van Ossenbruggen 2019, 381–82)

Their suggestions for digital tool criticism are directed at stages of *working with* digital data; still, I find their criteria very useful to also scrutinize the question of what happens in the process of *capturing* digital data. In the opening paragraph of this article, Koolen et al. list questions that need answering when taking tool criticism seriously:

> Questions to ask about digital data: where do the data come from? Who made the data? Who made the data available? What selection criteria were used? How is it organized?

> What preprocessing steps were used to make the data available? If digitized from analogue sources, how does the digitized data differ from the analogue sources? Are all sources digitized or only selected materials? What are known omissions/gaps in the data? (Koolen, van Gorp, and van Ossenbruggen 2019, 383)

My concern lies not with the ontologies of analogue versus digital images, photographs, and film – a topic that archivists and scholars in the field of film studies, media studies and art historians have theorised to a great extent and with sufficient drama.[6] Instead, I propose to look at decisions that are made in the process of digitisation. Inspired by Olesen's (2017) work on digital tools in film history and his reflection on the impact of digital tools and research environments on possible research designs and research questions, I, too, want to investigate the epistemological underpinnings of decisions made in that process, asked from a perspective informed by archival needs and media theory: what type of research questions are enabled or constrained by particular methods of documenting analogue objects, and which understandings of the analogue object do those digital images reflect?

Questions on the epistemic implications of digital images are not new in the field of digital humanities; they have, however, been debated mostly with respect to data visualisations. As Johanna Drucker (2011) argues in her famous essay 'Humanities Approaches to Graphical Display', data visualisations all too often employ a (visual) rhetoric of merely documenting the presumably objective evidence of statistical data.[7] In the field of film history, the researchers affiliated with the project 'Mapping Desmet'[8] raised the problem of gaps in corpora and documentation, and the different results that a researcher gets when making use of different data sets that all aimed to document (parts of) the Desmet collection, emphasizing the need for data visualisation tools that express uncertainty (Olesen et al. 2016).

Any digitisation of analogue objects is a type of quantification and data generation by virtue of the digital form: digitisation dissects the analogue object into units and creates information in the form of discrete code that is, in my cases, visualised through software in the form of a digital image. I will focus on the qualitative and pragmatic aspects of digital images when encountered online, having in mind users who investigate the visual/visualised information of the digital image. This means that questions of file formats, resolution, and size – although relevant for source critique – are not the focus of this paper.[9] Investigating decisions in the way an analogue object gets documented through digital means thus falls between analogue source critique (as outlined by Fickers 2012, quoted in Koolen, van Gorp, and van Ossenbruggen 2019, 372) and digital tool criticism.[10]

Lantern slides analogue/digitised

Already in their analogue form, lantern slides oscillate between the materiality of the slide as carrier of visual information (the slide as object) and the immateriality of the projected image on a screen (the intended use and experience of the object). Vogl-Bienek (2016, 20–22) distinguishes these two appearances as 'Glasbild' and 'Lichtbild' or 'Laternbild'. The literal translation of 'Glasbild' – 'glass slide' – emphasizes the *material base of the object*, conceptualised as a 'technological-operative artefact' (ibid, 20). 'Lichtbild' literally translates to 'luminous image'; 'Laternbild' to 'lantern image'. Both emphasise the *form or nature* in which the image is perceived through its intended use, i.e. in projection onto a screen or another opaque surface.[11] This has a slightly different connotation from the English term

'screen image', which emphasises the *location* of the experienced image in performance. The terms 'Lichtbild/Laternbild', 'luminous image' and 'screen image' thus accentuate different aspects in the *dispositif* of a media practice in which the object is involved in the audience experience of a specific media form on a specific location.

When digitising objects of lantern heritage, digital copies of slides require another distinction: alongside the *image content* of the slide – which I will call the 'motif' of the slide – there is the 'image *of* the lantern slide', i.e. the digital image that documents a lantern slide (that also contains a motif). These remarks on semantics and terminology may appear pedantic but they matter for the understanding of the object, the meaning attributed to its appearance, the way in which we interpret it when we produce (digital) reproductions, and the digital image. This essay will consider such questions from a practical perspective.

What is a lantern slide?

In order to digitise any object with an ambition to document it, basic knowledge of the properties, historical meanings and uses of the object type are required. Lantern slides may appear to be simple objects, but they are embedded in complex relations: they are part of local production chains (Roberts 2016), and they are related to performers and organizations (Eifler 2017), dissemination networks (Dellmann 2016), technology and apparatus (Rossel 2008) and venues (Brooker 2013). They are archival objects that need handling (van Dooren 2014; Herrera 2009). They were a communication tool in public discourse (Crangle and Vogl-Bienek 2014) and, via the transmedia circulation of narrative, motifs and genres, are also connected to other visual media such as film (Braun 2018), popular print (Mostert 2012), or Victorian melodrama (Kember and Crangle 2018).

Every lantern slide is, first, a material artefact, that, second, serves as 'technical image information' (Vogl-Bienek 2016, 40) for the projection apparatus. Third, lantern slides are handled by a projectionist who carries out the task of 'processing' the image-information of the carrier into the realised images, with the help of a technological apparatus, the magic or optical lantern. Fourth, the lantern slide has a fleeting form of appearance: in projection, the motif of the 'glass slide' appears magnified as 'luminous image' manifested as a screen image. Fifth, every slide was part of a sequence with other images. Sixth, lantern slides are relics of live performance practices that also include(d) an audience and aural elements (music, sound effects, spoken word). Even the most ordinary lantern slide appears as a complex thing, once its various contexts are considered.

How to document a lantern slide?

In the 'Million Pictures' project, we joined forces with museums, libraries and archives who wanted to make their lantern slide collections available online. For the online presentation, we used the Lucerna database. Together, we intended to develop a standard for digitisation and suggest a workflow for future digitisation projects. One year into the project, we recognised that the plan to publish a manual of best practice that suits everyone's needs was not only impractical but also impossible: the exchange on workflows for cataloguing and digitising during our second workshop prompted us to realise that the aims of digitisation projects vary too much for a 'one-size-fits-all' solution (Dellmann 2018 [2016]).

The variation of online displays of digital reproductions of lantern slides from various institutions serves as evidence of the heterogeneity of methods for digital documentation. Alongside the object-type-specific Lucerna reference database and its 'sister', the research platform eLaterna,[12] most museums and archives publish their digital objects on their own institutional websites, and, eventually, other resources of cultural heritage such as Europeana. The lantern slides that were documented digitally as part of the Australian project 'Heritage in the Limelight' (2016–2019) will be made available via Trove, the National Library of Australia's portal (see National Library of Australia 2016).[13]

In the following, I will compare digital copies of lantern slides that were published by different institutions and seek to explain the variation in the different forms of online documentation. This difference in achieved digital copies, I contest, is a great source for analysing the various interpretations of the analogue object that the producers of the digital copies hold – interpretations which too often remain implicit. I will take the digital images of lantern slides and analyse them with respect to the function that the digital image fulfils in its institutional and digital environment and, by 'reverse engineering', unpack the underlying understanding of the analogue object. Judging from the results of specific digitisation projects, I will address the consequences of the decisions made and how the achieved digital copy facilitates and restricts subsequent uses and research designs.

Implicit epistemological choices of digital documentation

Figures 1 and 2 are photographed with backlight and front light, documenting the motif as it could have appeared in projection alongside information that historical audiences could not have seen (binding, labels, and titles scratched into the slide's emulsion). This way of documenting lantern slides is informed by an interest in both motif and contextual information of the slide, the context, here, including the number of the set ('XIX' as in Figure 1 or 'Do. 459′' as in Figure 2), the number of this slide within the set (14 or 8) and the negative number of the slide (in Figure 2 this was 82292) as well as the label of the distributor (in Figure 2, this was Capi). These copies provide information on production and distribution and meet the needs of media historians who study networks of production or dissemination of lantern slides and their motifs. They do not, in the first instance, present the object in the way the slide was used during performance.

Figure 3 is scanned or photographed with backlight only. It documents the motif on the slide and also gives information about the relative size and format of the carrier. In contrast to Figures 1 and 2, labels and details of the binding are not documented. Figure 4 only reproduces the part of the object that displays the motif and does not document the wooden frame in which it was mounted. In Figures 3 and 4, information on the carrier is restricted to entries in metadata fields. From the digital image alone, even an experienced lantern slide researcher would not be able to determine that Figure 4 documents a lantern slide.[14] Figures 3 and 4 are probably produced with a primary interest in the motif, the iconography and the image as a concept or with the wish to document how images looked when presented to an audience. (However, they do not replicate that experience: audiences would not have seen the edges of the frame and thus the format of the slide; the black on the slide hindered the light of the lantern from shining through, which meant that such slides did not provide the screen-image with a clearly perceptible rectangular frame).
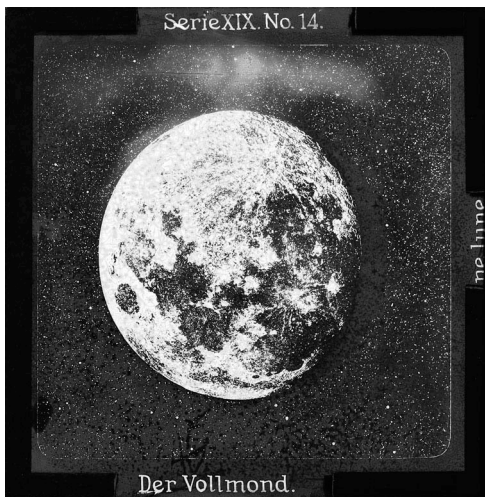
Figure 1. The simple thing that is so hard to describe. Left: Projektion für Alle, 'Der Vollmond', slide 14 of 24 from slide set *Serie XIX – Die Sternenwelt und ihre Wunder*, c. 1910. Standard format lantern slide, 8.3 × 8.3 cm. Courtesy: Eye Film Institute Netherlands. Image taken from Lucerna at http://lucerna.exeter.ac.uk/slide/index.php?language=EN&id=5100941. Digital image: Sarah Dellmann (CC-BY 2016).

Figure 2. Right: Ed. Liesegang, 'Gewächshaus mit Kakteen', slide 8 of 12 from slide set *Dodeka 459 – Kakteen und andere Sukkulenten*, c. 1910–1920. Standard format lantern slide, 8.3 × 8.3 cm. Courtesy: Eye Film Institute Netherlands. Image taken from Lucerna at http://lucerna.exeter.ac.uk/slide/index.php?id=5104240. Digital image: Sarah Dellmann (CC-BY 2016).

Figure 3. (Left) Unknown producer (in/after 1892), 'Ramsgate Harbour', slide 8 of 35 from slide set Heroes of the goodwin sands. Standard format lantern slide, 8.3 × 8.3 cm. Courtesy: Kirklees museums and galleries. Image taken from Lucerna at http://lucerna.exeter.ac.uk/slide/index.php?id=5034150. Digital image © 2009, University Trier. Reproduced with permission.
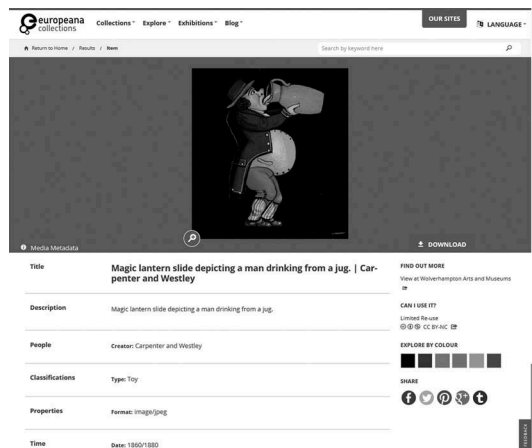
Figure 4. (Right) Screenshot of slide as presented in Europeana. Carpenter and Westley (c. 1860–1880), magic lantern slide depicting a man drinking from a jug. Lantern slide, c.10 × 15 cm. Courtesy: Wolverhampton arts and museums. Image taken from Europeana at https://www.europeana.eu/portal/en/record/2059517/data_foodanddrink_WAGMU_D351_22.html (accessed 8 August 2019). Digital image: CC 2016.
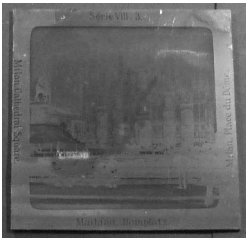
Figure 5. (Left) Projektion für Alle, 'Mailand. Domplatz', slide 3 of 24 from slide set *Serie VII – Italien, I. Teil: Vom Lago Maggiore bis Venedig*. Standard format lantern slide, 8.3 × 8.3 cm. Courtesy: Amsterdam: Eye Film Institute Netherlands. Digital image: Sarah Dellmann (CC-BY 2016).

Figure 6. (Centre) 'Glasplader til Laterna Magica (14 i æske)'. Lantern slides of unknown German maker, in toy format, 13 × 3.5 cm. Courtesy: Energimuseet, Denmark. Image taken from Europeana: https://www.europeana.eu/portal/record/2058618/object_KUAS_7702611.html. Digital image: Energimuseet Denmark (CC-BY 2016).
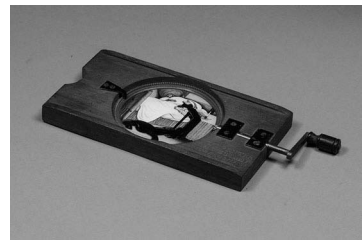
Figure 7. Carpenter and Westley. *The Ratcatcher*, c. 1890. Lantern slide with rack work mechanism. Digital image: © All rights reserved illuminago collection. Reproduced with permission.

Figures 5–7 focus on the object character of the lantern slide. In Figure 5, the slide is placed on a dark background and photographed from an angle slightly lower than 180 degrees, documenting the thickness of the glass and damage on the emulsion, while the motif itself is hardly visible. I took this photograph on location to experiment with ways of documenting damage in the emulsion for a discussion with the curator. Figure 6 is published on Europeana; it was obviously made from an archival perspective, but, as Europeana's guidelines permit, no additional information on the photographer or the aim of photography is given in the metadata: the reference number is part of the photograph, and the container, in which the slides are documented as well. This provides important information for cataloguing and collection management as it documents the slides in the context of the storage (the boxes) and the order system of the institution (the number). Here, too, the motif itself is hardly visible. Although Figures 5 and 6 are digital copies informed by the perspectives of cataloguers, curators, restorers and archivists, such documentation could also be of interest for scholars of technical art history as material properties of the object are captured.

Figure 7 is an intriguing case: photographed with various sources of frontal lighting (as evidenced by the shadows on both sides of the object), the slide is placed in a circa 45-degree angle ground position on grey cardboard and the camera is positioned in an approximately 130-degree vertical angle toward the slide. The motif of the slide is also clearly visible, indicating the use of backlighting. This, obviously, cannot be achieved through the cardboard; in order to achieve this effect, the cardboard was placed on a lightbox. A hole was cut into the cardboard that allowed the backlight to illuminate the part of the slide that was seen in projection.

This documentation captures information of the image-content, the materiality of the carrier (type of wood, thickness, crank and rack work mechanisms). Because of its high resolution, the grain of wood and notes inscribed onto the carrier can be studied

(at least those inscribed into or written onto one of the three visible sides that this image documents).

This image, however, does not present the screen image which audiences would see in projection. It is informed by edition theory and was taken by Ensemble illuminago in an early stage of the research project 'Media-historical, methodological, and media-technological Principles of the Digitisation of Works in the Historical Art of Projection' (2013–2017) at Trier University. The project's aim was to 'compile all media-historical, methodological, and media-technological principles relevant for the digitisation of the handed-down works of the historical art of projection' (Project website) in order to document them online and to issue study editions and critical editions of lantern slides for humanities researchers (but was not added as recommended process for digitisation in the digitisation guidelines). The resulting research platform 'eLaterna – Historical Art of Projection' was published as beta version in June 2018 and aims to initiate further digitisation projects of lantern slides. It is the most detail-oriented lantern slide database and contains extensive metadata on the analogue and digital object.[15] Ludwig Vogl-Bienek (2018) gives an overview of the challenges and aims in creating digital editions at the current state of research and preservation, which are useful for digital tool criticism and source critique of eLaterna and its displayed objects.

Figures 8 and 9, also photographed as part of the same project, document the same object in different ways: Figure 8 'dissects' the object into its components, revealing the complicated mechanism of the lantern slide for the creation of the effect on the screen: a ship moving horizontally through moving waves against a fixed backdrop of a harbour. From studying this digital image, we can deduce that turning the crank-handle produced the movements of both ship and waves.

Figure 9 shows all six exterior sides/edges of a slide, each taken frontally, with frontal lighting. On the right side, we see a composite image of the slide photographed on grey paper and of the same slide, taken from the same distance, with backlighting. These images were merged in post-production to this composite image that – like Figures 1 and 6 – combines information about the carrier with information about the image-content.

Figures 8 and 9 also were achieved in the early phase of the project. They are published as a model edition that contains other views of that slide, views of the other slides that are part of the set, and videos that demonstrate the movement mechanism, available for study in eLaterna.[16]

The documentation of Figures 7–9, we may suspect, requires a high degree of expertise of handling the material for reproduction, and in the preparation of the set-up. The resulting images could be used for close inspection of the various surfaces (as is possible in eLaterna) and even for creating 3D models in digital environments. Figure 8 also documents traces of the materiality – but only of one side of the slide, whereas Figures 5, 7 and 9 provide visual information about the thickness of the object and hence prompt the viewer to remember that all tangible objects have three dimensions. The top-left image in Figure 9 also captures the label glued to the side.

More types of digital images of lantern slides can be found online: there are video files and .gif animations for mechanical slides;[17] in some photographs, a ruler or a colour chart is placed next to the object.[18] On collector's websites and on ebay,

Figure 8 and 9. Unknown British producer, 'The Emigrant Ship – Slide 1'. Slide 1 of 10 from slide set *The Emigrant Ship*, in/after 1892. Parts of lantern slide with a complex moving mechanism. Size c. 10 × 40 cm. Courtesy: illuminago collection. By mechanical movement of different glass plates and their alternating occulation, the impression of moving images and waves on water is created. Digital images: © All rights reserved illuminago collection 2017. Reproduced with permission.

objects are often neatly arranged to attract potential buyers or to give an overview of a group of objects.[19] The interactive display developed by CIFOG (2017) for the temporary Exhibition 'Light! Magic Lantern and the Digital Image. Affinities between the Nineteenth and Twenty-first Century' (Museum of Cinema Girona 2017–2018) is obviously an educative tool, informed by the museum's requirement to provide knowledge on how the historical objects were handled without letting visitors touch the historical objects themselves (Figure 10).

This display documents the object and the screen image in a digital surrounding: a combination of hardware (a touchpad and a beamer) and software allows visitors to 'digitally handle' the slides on the touchpad and to see the effects of their engagement projected on a screen (CIFOG 2017). It allows the museum visitors to digital re-enact both object and projected image.

The various forms of documentation prove that there is not 'one (right) way' to document lantern slides or 'one (right) answer' to the issue of what 'a good documentation' of lantern slides is. My answer would be: a good documentation suits the aim of the digitisation project, clearly states the rationale behind the epistemological choices made and documents the technology chosen. In the following section, I will offer a detailed description of the methodology I applied for the digitisation of slides in three collections in order to facilitate source critique and tool criticism in our engagement with cultural heritage.

A case study for source critique: photographing on site with little technical expertise

As part of methods-testing in the 'Million Pictures' Project, I digitised standard format lantern slides from the collection of Eye Film Institute Netherlands (hereafter Eye), Museum Sonnenborgh – Utrecht observatory (hereafter MS-UO) and University Museum Utrecht (hereafter UMU). Eye holds around 10,000 slides in their archive, MS-UO more than 3,000 and UMU more than 30,000 lantern slides. As impressive as these numbers may appear, these are comparatively small collections and at the time were not completely documented on item level and/or with a digital illustration in the internal and/or online catalogues of the respective institutions.[20]
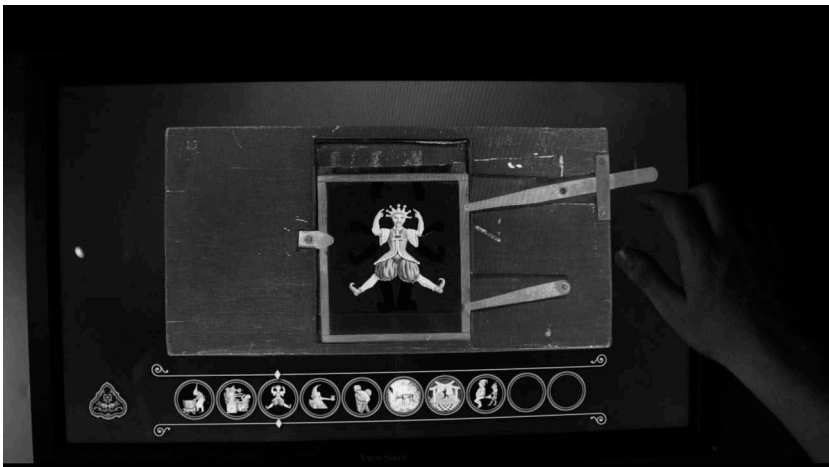
Figure 10. 'The magic lantern touchscreen'. Museum visitors can touch the screen to digitally move the handle and see the effect on a digital screen (not reproduced). Screenshot taken from the video *Light! The magic lantern at the museum of cinema in girona* (cicles formatius girona 2017) at 00:56. Available at https://vimeo.com/224476719 (accessed 14 May 2018). No license mentioned.

The aims of my digitisation efforts were defined, on the one hand, by the minimum quality requirements for digital images in Lucerna,[21] and on the other, by the objectives of AMP: to explore the potential of these artefacts of cultural heritage for interested people, including researchers, artists and members of the general public. Making images of slides available online, we argued, is crucial to increasing awareness about the existence of collections and to sparking interest in doing something with them. We further wished to inspire and support digitisation and preservation activities of slide collections held by our partnering museums and archives and beyond. The method I chose was thus directed to produce a large amount of digital copies, accepting compromises in quality. This ties in well with Lucerna's ambition to increase the relevance of the resource through an increase of records. As the digitisation was carried out in collaboration with curators in museums and archives, the resulting digital copies also needed to meet the respective institution's aims. At the beginning, no detailed inventory of slides was available for the three collections, so we agreed that one aim of the digitisation would be a refined inventory of the respective collections, and that resulting digital copies of slides should be usable both for the archive (for the internal catalogue and for public communication), and for researchers. In the course of the 'Million Pictures' project, I published about 3,300 digital images of slides online.[22]

Aims and practicalities

These aims resulted in the definition of three main principles. First, the process should document a large number of slides in the available time. This implied capturing as much information as possible in only one or two images per item, since taking several photographs of each item would result in fewer documented

items. It also meant reducing the time spent on post-production to a minimum, accepting compromises in quality. Secondly, the slides had to be photographed with a time-efficient method on location, which prioritised rapid capturing of objects in the archive with the possibility to carry out post-production elsewhere, instead of possibly more time-efficient methods of post-production that require more work on location.[23] Thirdly, the digital copies had to be suitable for retrieval, cataloguing and inventorying, online presentation and standard publication, which calls for the production of copies in different qualities: lower resolution for online presentation and as illustration in the catalogue, and higher resolution for other forms of publication (in print or large-scale digital presentations).

The digitisation method tested in my case study was further informed by practicalities such as skill, technology, access to collections, available time and finances. I am not a professional photographer, and as I had to work in the archives' storage locations, my access was limited to days that the curators were working there, too. With the available funds, we could buy decent equipment but could not have afforded professional cameras (nor the training to operate them) or pay third parties for digitisation work.

Method and equipment

After consultation with my colleague Richard Crangle who carries out digitisation of slides under similar conditions, I decided to test the method that results in digital copies
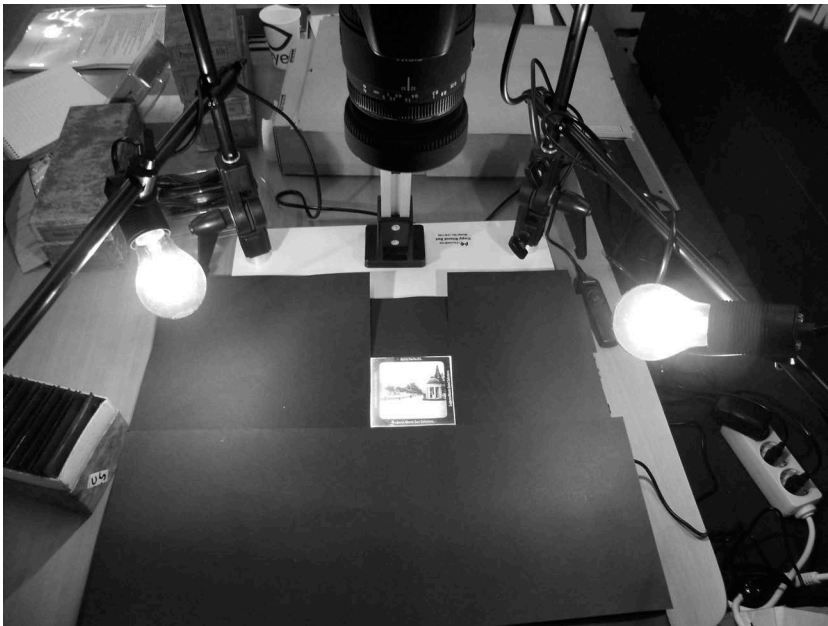

Figure 11. The set-up for the reproduction of lantern slides, consisting of reproduction stand, LED light-box for backlight (mostly covered), two blue light bulbs for front light, cardboard, camera, macro-lens. Digital image by the author (CC-BY 2016).

of the kind seen in Figures 1 and 2. I bought an LED lightbox, an automatic reflex camera and a second-hand macro lens as well as a reproduction stand and blue light bulbs.[24] The slides were placed on the lightbox. Black cardboard placed around the slides reduced reflection. Two blue light bulbs provided front light. The camera with macro lens was fixed to the copy stand and photographed the slides from 180 degrees (Figure 11).

Camera settings were put to automatic (auto-focus and auto-colour recognition), and photographs were taken as .raw files. After some early experimentation, I took around 600 images from about 500 slides during a seven-hour day in the depot. After establishing a routine, processing of the image files was reduced to about 6 minutes per captured lantern slide, including copying, safeguarding in back-ups, modification, transformation, creating smaller resolution for web-display and upload of files with basic metadata to Lucerna.

Post-production

After the photographs were taken, the files were converted to (uncompressed) .tiff. I cropped the margins, rotated the image to a fairly straight position and eventually changed the contrast in image editing software (GIMP and Photoshop). The resulting images are circa 20 MB large and good enough for average print publication or projection with beamers in lecture halls. I subsequently ran a batch process to create derivate files in .jpg. The smaller .jpg files were then uploaded to Lucerna. The museums received the files in both qualities (.tiff and .jpg) for their digital archive and online presentation.

Evaluation of the method

This method met the requirements that were defined before the digitisation process: the results (see Figures 1 and 2) document a relatively large number of slides per hour; various information from slides is documented in one photograph per slide; the quality is good enough for cataloguing, inventorying, consultation and retrieval. Both the information on the label and the information for the projection of the image are documented, making the resulting images useful for many research purposes focussed on content, context or both. Potential users interested in digital re-enacting of the screen image can transform 'my' digital files with minor effort in image editing (cropping or blackening the margins).

The results of this method come at the cost of compromises in other respects: the information on the production process of the slides is limited. Unlike the documentation of Figure 5–9, information on the lantern slide's production process and the material qualities of the object is quite poor: while it is visible that the slide consisted of several elements (glass, binding, labels, cardboard masks to frame the motif), the exact material composition is less evident. Figure 8, for example, details how the wooden frame was assembled. Furthermore, most forms of damage on the slides are not documented in the images I produced: damage in the emulsion, as seen in Figure 5, is better visible from a lower angle and nearly invisible when taken frontally; only loosening of the binding and cracks in the glass are visible in the method I tested.

Furthermore, the image files that I produced do not allow a detailed digital study of the object; even though the .tiff versions allow zooming in and hence allow for a relatively close inspection, this possibility is limited to one side of a slide and misses, for example, labels attached on the slide's edges (as visible in Figure 9). Photographic capturing of the edges of a lantern slide requires a stand for fastening the slide and adjustment of the camera. This, in turn, requires additional time for the set up and in post-production.

The documentation of colour is not exact, either. Working on location with portable equipment comes with the constraint of not being able to fully control light. In addition, I set the camera settings to automatic colour recognition and opted not to place a colour strip next to the slides in order to reduce time for file conversion to copies for online display. I sometimes heightened the contrast of digital photos in post-production without feeling it to be ethically problematic: the exact colour of the slide in performance is impossible to reconstruct anyway, as it varied – even in history – with the lantern, the light source and the colour of the screen. For analogue, projected images, in my opinion, there cannot be a true documentation of colour (although I am aware that there are reasons to think more carefully about this decision, e.g. when the material properties of the colour, pigments of the paint or processes to tint slides, or exact investigation of colour shades within a corpus are at the core of the researcher's interest).

And last but not least, the method I employed does not provide much information for decisions on conservation measures. As agreed with the curators, all I did was to remove the thickest layers of dust with a cotton handkerchief. A thorough cleaning and repacking of slides as well as the evaluation of the slide's condition was confined to the curators and restorers in the respective institutions.

Is this a good method? It obviously has a number of shortcomings. From my own pragmatic perspective, the answer is yes: this method meets all requirements that were defined prior to the digitisation process and all involved parties have been very satisfied with the results. From an epistemic perspective, the question is more difficult to answer: does this method produce images that document the object in a 'good' way? Figures 1 and 2, that were achieved using the method I described above, for example, were taken in one shot and produce 'documentations' of the slides that do not mirror how the objects are generally perceived or experienced: in history, as today, people would *either* see a bright image of the projected slide *or* the information on the label, but not both at the same time. A digitisation method that aims to give a reconstruction of the experience of the object would surely define other criteria for what a 'good' digitisation is.

Conclusion: reflections on the digitised

Michael Piotrowski (2017) has suggested considering digital reproduction, in his terms 'transcription processes', of historical texts (in his case, hand-written medieval manuscripts), as models. Digitised items from analogue objects, he argues, are made to represent the original, which involves selecting properties to be captured in the transformation process, implying a reduction of complexity, and to fulfil certain functions, which the model sometimes can accomplish better than the original object. These characteristics – representation, reduction, and pragmatism – are central elements of Herbert Stachowiak's model theory (1973), which Piotrowski

(2017) suggests we apply to understand digitised items. Even though Piotrowski exercises his thoughts on digital reproduction/transcription of the written word, his suggestion can easily be adapted to digital reproduction of images: through Stachowiak's terms, any digital reproduction of word or image is then considered a *representation* of the original (mapping) which, by definition, does not capture all features but only those relevant to the model creators (reduction). Hence, the resulting models have been designed not only to stand in for the originals, but also to fulfil pragmatic *specific functions* in their replacement of the original. Defining digitised objects as models of the originals thus leads to a clearer conceptual understanding of the epistemological status of the created copies.

One advantage of understanding items resulting from digitisation through model theory, i.e. understanding the item resulting from digitisation as *representation* of the analogue rather than as *copy*, is that it strengthens the argument for keeping analogue collections (and allocating money for their preservation) after digitisation projects have been carried out. The term 'model', after all, implies that it is an object of another nature and that it does not fully replace the original.

The implicit choices made in how analogue objects are modelled in the process of digitisation, and the resulting images have a significant impact on possible future research designs that make use of those digital images. Before the era of digital access, when researchers had to go to archives, libraries and art museums in person to consult the objects they were interested in, such questions might not have been as urgent as today: after all, the same physical lantern slide provides the information necessary for scholars interested in the changing quality of glass, the history of fonts used on labels, the aesthetics, techniques and processes of illustrations, the development of serials, or content exchange among various distributors. But as I have shown, not every digital reproduction provides information for all of these research interests.

The analogue object's materiality, its digitised form, the digital reproduction technology and the online environment in which the digitised objects are displayed all have specific affordances that we need to investigate with respect to their epistemic qualities as part of source critique and tool criticism. Scholars in (comparative) literature studies, media studies and more, convincingly demonstrated that every translation, transcription or format change of a text, image, concept or object is always an interpretation of its defining and meaningful properties – whether they employ the concept of *ekphrasis* (Führer and Banaskiewicz 2014; Lindhé 2013) re-mediation (Bolter and Grusin 1998) or intermediality (Rajewsky 2002). We never 'just document' when we translate, when we change forms, even when we do so with a documentary ambition – as my case studies of digitally documented lantern slides have shown. Any digitisation method depends upon ambitions – personal or institutional – for the material, and this information is relevant for digital source critique and digital tool criticism. Seen in this light, digitisation projects can serve as a method or tool to explicate our (implicit) understandings of the (historical) objects and question. This will help when deconstructing the positivist assumptions ingrained in ideologies of technological progress and the promises of unlimited or even immediate access to things in the world that are, still, too often heard in connection with 'digitisation'.

Notes

1. A recent overview over general issues at stake in cultural heritage digitisation projects from a collection point of view is given at the website 'Digital Pathways' by Collections Trust (2019). See http://digitalpathways.weareculture24.org.uk/pathways/what-does-digitising-collections-involve/(accessed 19 June 2019).
2. A recent case is the Rijksmuseum Amsterdam's 'Operation Night Watch' (2019), the digital restoration of the famous oil painting *Night Watch* by Rembrandt from 1642, which started in 2019. The digital operations are documented and disseminated in live streams and via various social media accounts. The entire restoration process is marketed as a special event that can be witnessed in the exhibition. See https://www.rijksmuseum.nl/en/nightwatch (accessed 10 August 2019).
3. See http://a-million-pictures.wp.hum.uu.nl/(accessed 10 August 2019).
4. See https://lucerna.exeter.ac.uk (accessed 10 August 2019).
5. See https://www.europeana.eu/portal/en (accessed 10 August 2019).
6. Some participants in this debate even considered digital images the end of photography or film due to a perceived loss of photography's indexical relation to the real world. A concise overview of this discussion from both a scholarly and an archival perspective is given by Fossati (2019, especially 21–36). See Männig (2018) for a reconstruction of the discussion on digital methods in the field of art history.
7. Drucker (2011) emphasises that data (in her case, lexical expressions of concepts that are used as categories in the presentation of data visualised in charts) are themselves the result of social conventions and hence, the result of interpretation – and certainly do not give unmediated access to phenomena in the world: 'Nothing in intellectual life is self-evident or self-identical, nothing in cultural life is mere fact, and nothing in the phenomenal world gives rise to a record or representation except through constructed expressions'. For a recent case study discussing ethics of visualisation, see Hepworth and Church (2018).
8. The project aims of 'Mapping Desmet' (2014–2015), carried out by researchers at Eye Filmmuseum and the University of Amsterdam, were to map the distribution and screening of films from silent film entrepreneur Jean Desmet. By combining information from written sources (business records, reviews, posters, announcements) and preserved film copies, it combined textual and contextual information in its mapping tool. See www.mappingdesmet.humanities.uva.nl/(accessed 19 June 2019).
9. Some of my observations are not exclusive to digital images but also concern e.g. analogue photographs of cultural artefacts. However, given that digital images published online are the form though which institutions of cultural heritage make knowledge on objects available, this article focusses on digital images that document the analogue objects.
10. According to Fickers (2012) as quoted in Koolen, van Gorp, and van Ossenbruggen (2019, 372–73), analogue source critique asks: 'Who created the text? What kind of document is it? Where was it made and distributed? When was it made? Why was it made?' (ibid, 373). These questions are adapted by Koolen et al. for digital tool criticism as follows: 'Who made the tool? What kind of tool is it? When was it made? Why was it made? How does the tool function?' (ibid).
11. Because the term 'Lichtbild' is also used for photographs, and for projected images on diverse carriers (film strips, 35 mm slide projectors), Vogl-Bienek prefers the historical term 'Laternbild' in his later writings, as it is used only in relation to lantern slides. For a detailed reconstruction of terminology, see Vogl-Bienek (2014).
12. See https://elaterna.uni-trier.de (accessed 10 August 2019).
13. See https://trove.nla.gov.au/ (accessed 10 August 2019). Currently, the objects digitised in the course of the project are accessible via the web-based collection catalogue system eHive at https://ehive.com/collections/6553/heritage-in-the-limelight (accessed 10 August 2019) and the project's website at the Centre for Digital Humanities Research at Australian National University at http://cdhr-projects.anu.edu.au/limelight/(accessed 13 August 2019).
14. I wish to note that on the website of Wolverhampton Art Gallery, i.e. the owner of the physical object, four illustrations of the slide depict the object, two of which include the frame. See the

entry of the same item at the website of Wolverhampton Art Gallery: http://www.wolverhamptonart.org.uk/collections/getrecord/WAGMU_D351_22 (accessed 14 December 2018).

15. The platform was developed in collaboration between the Department for Media Studies at Trier University and the Trier Center for Digital Humanities (TCDH). It is freely accessible online at https://elaterna.uni-trier.de/. The two main resources on eLaterna, eLaterna Archive – containing the digital images – and eLaterna Companion, are expanded and evaluated in practice as part of the current project 'Performative Configurations of the Art of Projection for the Popular Transfer of Knowledge. Media Archaeological Case Studies in the History of Useful Media and the Screen' (2019–2021), coordinated at Marburg University. For more details on the project see https://www.uni-marburg.de/de/fb09/medienwissenschaft/forschung/projekte/forschungsprojekte (accessed 10 August 2019).

16. See https://elaterna.uni-trier.de/#/ae/130132?view=s-objectview (accessed 10 August 2019).

17. See e.g. the video of a mechanical slide on the YouTube Channel of the Museu del Cinema Girona: https://www.youtube.com/watch?v=sAcGf1-m9-c (accessed 19 June 2019) or the presentation of mechanical slides on Henc de Roo's collector's website 'De Luikerwaal': https://luikerwaal.com/newframe_uk.htm?/inh_platen_uk.htm (accessed 19 June 2019).

18. The slides published by Horniman Museum and Gardens on Europana all contain a digital ruler: https://www.europeana.eu/portal/en/record/2048087/ProvidedCHO_Horniman_Museum_and_Gardens_http___collections_horniman_ac_uk_objects_135667.html (accessed 19 June 2019), also see the illustrations in Herrera (2009).

19. See for example 'Antique MAGIC LANTERN ANTIQUE TIN TOY Laterna Magica With 12 Slides', advertised on ebay at https://www.ebay.com/itm/Antique-MAGIC-LANTERN-ANTIQUE-TIN-TOY-Laterna-Magica-With-12-Slides/223542990553 (accessed 19 June 2019), the overview image of a lantern and slides at Museum Boerhave published on Europeana at https://www.europeana.eu/portal/en/record/79/resource_document_museumboerhaave_V25779.html (accessed 19 June 2019), or a lantern slide from Norsk Teknisk Museum at https://www.europeana.eu/portal/en/record/2022608/NTM_NTM_27809_1.html (accessed 19 June 2019).

20. As I wrote in an earlier article for *Early Popular Visual Culture* (Dellmann 2016, 340–41), there are several reasons why this material has not yet been given priority in digitisation projects. However, it seems that there is an increased interest also within heritage institutions to work with this material. At Eye Filmmuseum, a long-running project to digitise the slide collection by method of scanning is currently underway. This method integrates the scanning process (which takes several minutes) into the work day of the curator, who can carry out other tasks while the scanning proceeds.

21. The minimum requirements for an image to be published in Lucerna, the technical details about resolution, file size, and quality were developed by Richard Crangle and are included in manual 'How to prepare digital images files for upload to Lucerna' (Crangle and Dellmann 2018), available at https://a-million-pictures.wp.hum.uu.nl/manual-images-lucerna/(accessed 10 August 2019).

22. 1,895 digital images of slides from collection Eye http://lucerna.exeter.ac.uk/collection/index.php?id=2500360; 1,114 from collection MS/UO http://lucerna.exeter.ac.uk/collection/index.php?id=2500365 and 338 from the UMU http://lucerna.exeter.ac.uk/collection/index.php?id=2500369 (all accessed 10 August 2019). A smaller number of slides from the collection of Eye and UMU were published by Aurora Kenney and Jeroen Splinter as part of a research internship.

23. In some archives, it is common practice to photograph or scan the object in the vault, connect the camera/scanner to a laptop with wireless internet access and catalogue the object in the institution's catalogue (either on internet or intranet), creating a catalogue entry and adding the digital image to the record in one go. This is more time-efficient with respect to number of achieved records with digital images per hour, but less time-efficient with respect to 'raw' items captured per hour.

24. The equipment cost a total of 900 Euros in 2015.

Acknowledgements

Disclosure statement

Notes on contributor

Sarah Dellmann is a film and media historian with expertise in European visual culture of the nineteenth and early twentieth centuries. Her research interests lie in the field of magic lantern, early cinema, information science questions concerning the documentation of cultural heritage, and research methodologies. She initiated and coordinated the international project 'A Million Pictures. Magic Lantern Slide Heritage as Artefacts in the Common European History of Learning' (2015–2018), and is one of four directors board of the Lucerna Magic Lantern Web Resource CIC, affiliated researcher at the Moving Image Research Group at the University of Amsterdam and works at Kassel University Library.

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