The artefact as a time machine: A safe way of sending our historic digital photographic panorama of London's Docklands two to three hundred years into the future

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ABSTRACT: While museums and archives digitise their collections for wider access online, and to reduce handling originals, digitised data files may not survive any longer than the artefact being copied. We cannot predict how born digital image data, such as our historic 2008 panorama of London's Riverscape will need to be migrated from one file format, or storage system to another, nor the risks from technical mishaps, 'bit rot' or human error. This paper proposes archiving such vital images and documents as hard copy inkjet prints, not in place of digital storage and migration, but as an insurance, based on well-known conservation methods, using acid free paper and pigments.

1. INTRODUCTION

In 1937, the Port of London Authority (PLA) commissioned the then, longest photographic panorama in the world, covering both banks of the River Thames for some 9 Kilometres from London Bridge, downstream to Greenwich. This was rediscovered in the 1980's, while archivists were looking for items suitable for the new Museum in Docklands, London.

Figure 1: *Wapping waterfront section of 1937 and 1997 Riverscape Panoramas*

In 1997, we undertook to remake the Black and White printed panorama using Fuji 120 size, 6cm x 17cm transparency film. This is presently archived in the Museum of London and with a archival life of some 70-100 years in it's present cool, dry, storage conditions.

In 2008, the PLA asked us if we would re-make the London's Riverscape Panorama yet again, this time using digital photography, to be completed for their March 2009 Centenary celebrations. At that ceremony, we were asked if the 1937 Silver Gelatine Black and White printed panorama, already over 70 years old would be likely to survive until the PLA's Bi-centenary in March 2109 ? Since the original prints were carefully archived by the Museum of London, we responded that it was very likely indeed, as many Silver Gelatine prints survive to this day from the Victorian era.

The PLA Director then said that he 'assumed' that there would be no problem for our 2008 Digital Photography Riverscape Panorama to be available for their Bi-centenary, in only 100 years time? At the time, Mike and I had both recently written a Digital Image Conservation Module, when I was Course Director of a Postgraduate Photography programme at the London College of Communication. We were very concerned about the fragility of image data, both in storage and predicted regular migration. If our 2008 digital panorama was to be archived in the Museum of London solely as data, there could be no guarantee at all that it could survive for the next 100 years.

We decided to research an alternative, and much safer method of archiving our panorama and also other historic digital photographs and designs, by sending them 2-300 years into the future, not as digital data, but as printed artefacts, using historically proven technology.

2. IMAGE ARCHIVING CONCERNS

The best archiving and curatorial practices for traditional silver halide photographs are very well established worldwide. The fact that the dyes used in post world war two colour negative and transparency films, would begin to fade in as little as 30 years, was probably less anticipated by the photographers of their particular era [1].

The vast majority of the world's digital image files are presently stored outside professional archives, and their makers will be very lucky indeed if they can still be accessed and viewed in a mere ten to twenty years time. Since the technology continues to evolve rapidly, there is no certainty that the image creation, storage and retrieval devices of the future will continue to be based on today's popular digital platforms [2].

Our great grandfathers Victorian black and white photographs could well outlive those colour film dye images shot by our parents, which may themselves last far longer than most of the millions of digital images that we shoot today.

We can walk into any nation's Art Gallery and view paintings made 4-500 years ago. Some may have needed to be carefully cleaned, but when this is done, the colours of the pigments will have hardly changed from the day that they were painted. Our project is to research how we could select and send our most significant artworks, digital photographs and documents forward into the 23rd century or beyond, as smaller, high-resolution inkjet prints, as an alternative to digital data. The image could then be recovered from print-outs made today, with minimal loss, using whatever capture or scanning technology may be used, hundreds of years into the future.

3. WHAT CAN POSSIBLY GO WRONG IN LONG TERM DIGITAL DATA ARCHIVING ?

RAID (Redundant Array of Independent Disks) and Cloud computing technologies can be very good, allowing digitised files to be simultaneously stored on several servers in different parts of the world. Hence it would be wrong to say that best efforts are not being made to preserve the world's most important digitised, and 'born digital' data files. However, in addition to ever-changing technology, our world is subject to uncontrollable natural events such as extreme weather, earthquakes and floods, to name but a few. Newly discovered risks from the effects of sunspots and solar flares are also now a concern, and cyber attacks on a country's economic and cultural centres, are no longer the stuff of science fiction, but a real and serious threat.

Those of us who have suffered from a hard drive failure on a home computer, or data loss from a server failure at work, will already be well aware of the ultimate fragility of digital data. The natural degradation of stored data (sometimes referred to as 'Bit Rot') [3] and data corruption and losses during migration, are less familiar issues. There is no guarantee that evolving technology, such as the storage of massive amounts of data on strings of DNA, for example, will not be so radical, that today's files are totally unreadable by the computers that will be used in 50, or even as little as 25 years from now. Relying on 'backing up' is unlikely to be enough, longer term.

Smaller specialist archives may well not have the resources or the skills needed to meet the challenges of digital migration. Nor are they likely to have the budget to employ specialist companies and institutions to look after their data for them. The problems are huge, from simultaneously migrating and translating digital data on numerous websites and servers worldwide, to writing data to optical discs or solid state drives, with no guarantee at all that there will be any devices able read them in 50 years time. We also hope or assume that our yet unborn, great grandchildren's sons or daughters will be discerning enough to look after our 2015 digital pictures, in today's 'weird old formats'. It does not follow that any 'financially challenged' Museum of 2075, is

going to have the time or money to convert, re-save and migrate our 2008 panorama for the 20th time, just so it can make it to the PLA's bi-centenary, particularly if by then, curators think some other newer documentary archive is considered to be more important.

Hence there is a big risk that our Riverscape Panorama files will either end up in a futuristic computer's Trash Bin, or just get left behind in a redundant media or file format, to gather dust and never be seen again. Curators have always known how to care for and preserve 'artefacts'. It is human nature not to tear up an old Victorian photographic print, even if we do not like the image, but if we found a large file of boring and uninteresting digital photographs from year 2000, are we likely to carefully preserve them, or spend our limited time and money removing the LZW Compression, on all the tiff files, in case it is not supported in the future? Or would it not be all too easy to quietly slip those old digital images into the Recycle Bin ?

Any lack of standardisation from one present or future digital format to another will lead to considerable difficulties in consolidating or migrating collections. Thus, rather like the game of 'Chinese Whispers', during the course of repeated migrations, necessitated by updates in software or hardware, changes to the image data are exceptionally likely to occur. Many image archives are already storing a mixture of TIFF, JPEG and RAW files, collected from different sources. How long will these formats survive before, like JPEG2000, they run the risk of a lack of industry-wide support? Is The Cloud really a safe means of archiving? Apple Inc. co-founder Steve Wozniak recently said "I really worry about everything going to The Cloud, I think it's going to be horrendous. I think there are going to be a lot of horrible problems in the next five years."[4]

Our conclusion was that, as with our 2008 London's Riverscape Panorama in data form, vast swathes of our contemporary history and culture will be at risk being randomly lost or deleted through lack of space, a budget to migrate, or even a contemporary lack of appreciation of the images that we consider are important right now, in 2015, Or, like some indecipherable stone tablet, the images may be there, but the colour balance, density or meta-data containing all the image context may well have been stripped out and lost during numerous migrations. When dealing with dozens of migration processes, to send digital photographs just 100 years into the future, we should all also be very aware of human error and that one day, if it can possibly go wrong, it probably will go wrong.

4. THE LONG TERM ARCHIVING OF LONDON'S RIVERSCAPE PANORAMA

In 1997, Mike Seaborne, Charles Craig and Graham Diprose photographed a continuous panorama of both banks of the River Thames from London Bridge to Greenwich, five miles downstream [5], remaking a panorama first shot in black and white in 1937, for the Port of London Authority (PLA). We used 6x17cm Fujichrome 120 colour film, since at the time, this was considered to be one of the most archival dye-based films available. When, in 2008, the PLA invited us to make a new digital panorama, we decided we should also find an alternative to data storage of our TIFF files, even if entrusted to the considerable expertise of The Museum of London.

We convinced the PLA that the safest way to ensure that that the new digital image panorama would survive for their bi-centenary in 2109, was to make an ink jet printout to match that from 1937, copying the same lengths of sections and locations. Prints were made using our Hewlett Packard HP Z3100 pigment ink printer on Hahnemühle 188gsm Photo Rag paper. This allowed any river location to be viewed simultaneously in both 1937 and 2008 versions placed side-by-side.

Figure 2: *2009, Sections of the 1937 and 2008 Riverscape Panoramas are compared by PLA and Museum of London Senior Management*

Once completed, our newly archival ink-jet panorama was placed in blue leather folders similar to the 1937 panorama and in 2009, was presented to the Museum of London, as part of the PLA's centenary events. We handed over our TIFF files as well, but feel much more confident that the printed version will being part of the PLA's bi-centenary celebrations, than images from the data.

Figure 3: *One of the four leather binders containing the 2008 digital panorama are presented by the PLA to Museum of London*

5. RESEARCH METHODOLOGY AND TESTING

We were offered access to the entire PLA collection of historic photographs of London's Docklands for our book of the project, 'London's Changing Riverscape' [6] and we became interested in researching how these beautiful old historic images could also be archived further into the future, than in their present Silver Gelatine Print form. We had already made the assumption that the Silver Gelatine original prints were very likely to last much longer than the Museum's recently digitised photographic copies stored as data.

From a similar project with English Heritage, "…in the footsteps of Henry Taunt" in 2007, [7], we had a Hewlett Packard Z3100 A1 printer available to us, which still provides the most fade-resistant prints of any pigment inkjet printer currently available. Wilhelm Imaging Research, Inc. still rates this printer and its slightly modified successor the Z3200 as yielding longer-lasting prints on a range of archival papers than any other printer. [8].

Figure 4: *Images from the PLA photographic collection printed out at 16 up on A2 210gsm Canson Rag Photographique Ink-jet paper*

The choice of ink-jet paper was much less straightforward and a large number of different manufacturers and surfaces were tested. We correctly suspected that if the paper had a deep texture, this would interfere with the quality of the image recovered back through scanning or copying. The sharpness of the dot was likely to be an important factor, particularly if we intended to print images at a much reduced size. To assess how the nature of the paper surface affected dot sharpness, we tested several fibre-based and resin coated papers to determine the differences, if any, in dot bleed.

We made TIFF files of 64, 96 and 128 A4 pages from the Microsoft Word version of a new photographic textbook by Diprose and Robins. These files were loaded into Photoshop™, using Contact Sheet II, and printed out. The prints showed that, even at a scale of 128 A4 pages per A2 sheet, the text was still readable with a magnifying glass. Once a single tiny page was scanned and read into OCR Software we could count the number of errors as a measure of ink dot sharpness. Those words it could not recognise were flagged up in green by the software. The sharper the ink jet dot, the more words could be recognised by the OCR and the less green flagged errors occurred on the page. In this simple way, we could tell at a glance if a paper surface was likely to be suitable for our follow up experiments with PLA historical images.

We rapidly concluded that all matt papers tended to cause the dot to bleed into the paper fibres, while on most gloss or lustre papers the ink tended to form a tiny bubble on the paper

surface that gave a less complete, and accurate, dot shape.

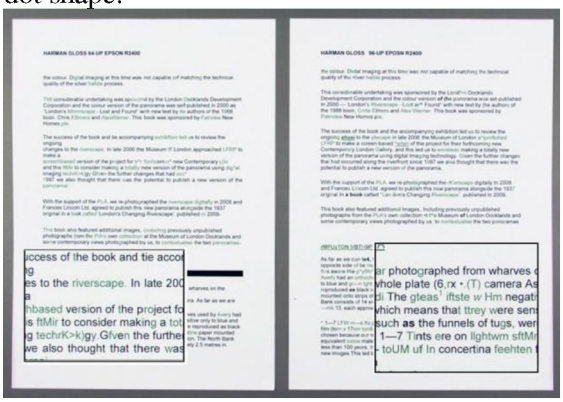

Figure 5 *Harman Gloss Ink Jet Paper shows many errors indicating the dot is un-sharp.*

Ortiz and Mikkilineni (Purdue University, Lafayette, Indiana, US) produced a paper on Inkjet Forensics in 2007 that reached the same conclusion as our own, that smooth Rag papers produced the sharpest dot [9].

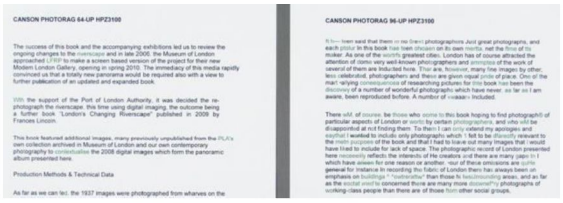

Figure 6 *Canson Rag Photographique showed hardly any errors and became our preferred choice for Long Term Image Archiving*

We were keen also to avoid choosing papers that contained artificial brighteners (Baryte) as these have been considered by a number of researchers to risk reducing the archival life [10]. If a paper has a very slight warm tone base that does not change over a long period of time, this seems advantageous over a paper where changes in brightness may or may not, be predicted.

Canson Infinity Rag Photographique paper with a special barrier layer that prevented the ink from sinking further into the paper base, also fully met the archival standards specified in ISO 9706, and gave us by far the best result of all the papers we have tested thus far. Additionally, this paper is internally buffered to resist gas fading, and is totally acid free to avoid any long term paper degradation.

We tested our methodology by printing out digital images 4 up on A2 (A4 size), 8 up on A2 (A5 size), 16 up on A2 (A6 size) and 32 up on A2 (A7 size). The printed images were then copied using a Nikon D800E digital camera fitted with a 55mm f2.8 Micro-Nikkor lens, which was found to give higher image quality than even the best affordable flatbed scanner. The digital copy files were then processed using Adobe Photoshop software to minimise the effect of the dot screen and to optimise image quality. Our Conclusion was that an image archived A4 would make a good quality A3 exhibition print, one archived A5 would be suitable for most book publication and an A6 printout was still very suitable for any Screen or Tablet output. A7 32 up images would be usable for web or viewing on any tablet or mobile.

6. RESULTS OF OUR CASE STUDY - JOHN CASS EAST END ARCHIVE

The Cass School of Art's East End Archive is an online digital resource bringing together not only historic bodies of work, but also that of many contemporary artists and photographers documenting London's East End. Initially the Director, Susan Andrews, and her team, had envisaged holding the archive purely in digital data format. However, following a Symposium held at Cass School of Art in 2011, where Diprose and Seaborne expressed their concerns over long term digital data storage and migration, it was resolved to run a pilot scheme using some of the East End Archive's images to test the viability of also archiving these digital images as reduced-size pigment inkjet prints.

Unlike most digital data archives where all files are stored and migrated at the same file-size, Susan Andrews and her team were able to choose to archive images at different sizes. This was not only significant for budgeting savings in production, but also was recognised as a clear additional indication to our unborn great grandchildren as curators of tomorrow, about what we, in 2015, felt was the most significant parts of our collection. Additionally viewing 32up A7 'Street Photography' pictures of Whitechapel High Street, gave a far better essence of life today in the area than from viewing individual images on screen.

Our method also addresses concerns where a particular colour cast was intentional, or a low key image was vital to the artist's vision. Bulk

data archiving risks unwanted changes through built in Auto-Colour or Auto Levels correction during every round of migration that will be needed to update to new software or file types.

7. CONCLUSION

We are not advocating using Ink Jet Print-out Archiving for every data image in a collection. However, for our own 'Born Digital' 2008 London's Riverscape Panorama, which we believe may be of some significance to scholars in 2-300 years from now, our methods seem to be a very sensible form of 'insurance'. Although inevitably there are slight losses through the rag paper texture and printer dot screen, over a period of 100 years or more, these may well be considerably less than 'drop out' losses through regular migration. Changes in contrast, density or colour management as data is modified while passing from one format or storage medium to another, no longer become a risk in a stable pigment ink print out.

Mike Seaborne and I will not be able to see if our 2008 Digital Panorama is part of the PLA's bi-centenary in 2109, but on the basis of our historical experience, that pigment inks on acid free paper can have an archival life of hundreds of years, we think our Paper Printout Panorama will be much safer time machine into the future, than our Digital Data version.

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