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PRESERVATION IN PERSPECTIVE

INTERNATIONAL STRATEGIES FOR THE PRESERVATION
OF WRITTEN CULTURAL HERITAGE

*Edited by the Koordinierungsstelle für die Erhaltung
des schriftlichen Kulturguts (KEK)*

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Preservation in Perspective

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International Strategies for the Preservation
of Written Cultural Heritage

Proceedings of the conference
'Preservation in Perspective' held at the James-Simon-
Galerie in Berlin, 23–24 November 2021

Edited by the
Koordinierungsstelle für die Erhaltung des schriftlichen
Kulturguts (KEK)

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**Koordinierungsstelle
für die Erhaltung des
schriftlichen Kulturguts**

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Welcome Address by Minister of State Claudia Roth, Federal Government Commissioner for Culture and the Media

Thanks to the many years and broad range of efforts successfully carried out by the Coordination Office for the Preservation of Written Cultural Heritage (KEK), the preservation of this heritage has become firmly established as a matter of national concern. Governments at federal, state and local level all regard it as their shared task. In the KEK's more than thirteen years of existence, its work in building strategic networks has made it the key point of contact for the nationwide coordination of preservation efforts.

One milestone in the history of the KEK was the publication of its *National Recommendations for Action* in 2015, which helped to increase policy-makers' awareness of the importance of preserving written heritage as a national task. Based on a thorough inventory of threats to the written cultural heritage in Germany, the recommendations formulate strategic goals for coordinating the preservation of original written materials across subject areas and federal state boundaries.

The next logical step came in 2017, with the start of the special programme of the Office of the Federal Government Commissioner for Culture and the Media (BKM) for the preservation of the written cultural heritage, when additional funding of one million euros was made available for the first time. The programme was gratefully accepted, and funding was increased further in the following years. Federal funding of some 18.5 million euros has made possible more than 600 projects to date. Federal co-financing of up to 50% and the necessary collaboration with the participating state and local governments and institutions also had a significant impact on the preservation of original written materials in Germany. The special programme encouraged many federal states to create their own funding programmes.

After more than thirteen successful years, and together with the Cultural Foundation of the German Federal States, which contributed to funding for the pilot projects from the start, we can look back on an impressive amount of support: a combined total of some 23.8 million euros in KEK funding for pilot projects and funding from the BKM special programme, which together have supported some 1,070 projects since 2010. This result was made possible by the enthusiastic and skilled efforts of the KEK, for which I am sincerely grateful to the KEK's director, Ursula Hartwig, and her team. In these times of increasingly difficult conditions and tighter budgets, it is important to secure the KEK's future and to continue working hard together to help preserve original written materials.

Preserving written cultural heritage means more than just saving the physical substance of books and documents. It also means preserving knowledge, under-

standing cultural identities, enabling future generations to experience history – and ensuring legal certainty. Because nothing can take the place of authenticity and the fascination of the original.

Berlin, February 2024

Welcome Address by Markus Hilgert, General Secretary of the Cultural Foundation of the German Federal States

What does original preservation of written cultural heritage look like at the Danish Royal Library in Copenhagen? What mass deacidification measures do experts at the Swiss National Library in Berne use to increase the lifespan of paper? How can AI help to turn fragments of the Historical Archive of the City of Cologne back into complete units? With this volume of papers from the two-day international conference in Berlin in 2021 entitled 'Preservation in Perspective', the Coordination Office for the Preservation of Written Cultural Heritage (KEK) shows the work being done nationally and internationally to save paper from irreversible decay.

The KEK has been campaigning for the preservation of written originals for more than ten years. In doing so, it strengthens interdisciplinary cooperation between archives and libraries in Germany as well as the development of infrastructure in the area of preservation of holdings. From the outset, the Cultural Foundation of the German Federal States, together with the Federal Government Commissioner for Culture and the Media, supported the Coordination Office for the Preservation of Written Cultural Heritage. On behalf of the sixteen German federal states, the Cultural Foundation of the German Federal States promotes, develops, advises and supports projects and initiatives in the areas of art and culture that are of national importance and implemented in cooperation with several partners. Its core tasks include the promotion of preservation of cultural assets that are of great value to the cultural identity and social coexistence of people in Germany.

Besides the preservation of written cultural heritage, it is also important to strengthen the resilience of those institutions that safeguard our cultural heritage. The energy and climate crises, the flood disasters in 2021 and the current armed conflicts show that the protection of cultural heritage is facing entirely new challenges in the twenty-first century, which is why the Cultural Foundation of the German Federal States decided for the first time in 2023 to provide the KEK with additional funding for projects in the area of emergency preparedness. The projects pursue the shared objective of improving regional emergency preparedness in the cultural sector, for example by establishing emergency networks for strategic cooperation. In addition, the Cultural Foundation of the German Federal States launched the Emergency Alliance for Culture [Notfallallianz Kultur] in 2021, whose partner institutions include the Coordination Office for the Preservation of Written Cultural Heritage. As an alliance for society as a whole, it is oriented towards institutions and organisations in Germany that contribute independently to emergency aid in the area of culture in crisis and emergency situations within the scope of their specific

capabilities and possibilities. Strengthening the resilience of museums, libraries and archives against insidious but also concrete dangers and crises is an important and honourable concern in the service of our cultural memory, and we are pleased to support the Coordination Office for the Preservation of Written Cultural Heritage on behalf of the sixteen federal states.

Berlin, February 2024

Introduction by Ursula Hartweg, Director of the KEK

One may well wonder why the projects which the Coordination Office for the Preservation of Written Cultural Heritage (KEK) supports played only a minor role at the international 'Preservation in Perspective' conference, which the KEK invited them to on the occasion of its tenth anniversary in 2021. By this time, the KEK had already supported 850 projects totalling around 13.8 million euros. Why were thirteen international speakers from nine countries invited compared to six from Germany, of whom only one reported on a KEK project?¹

This was because the conference was not intended to be a KEK showcase. We considered it more important to create space for an international exchange on the topic of preserving written cultural heritage in the original: an exchange which, in this form, did not yet exist. The focus was on different national strategies for sustainable preservation as well as the potential of international cooperation. Questions were asked about areas of development in preservation and synergies between preservation and digitisation were presented. In this way, we brought together contributions from very different people, all of whom are committed to the cross-sectional task of preserving originals with great expertise: conservators, staff responsible for collections, managers of institutions, academic researchers and colleagues from non-profit organisations. For a long time, such a conference format has been a desideratum in Germany and so in 2021 we addressed this by holding this international conference.

But first, the host organisation, the KEK, with its specific features, especially when compared internationally, will be briefly outlined. In the lead-up to the conference, we invited experts on the protection of cultural assets in archives and libraries to an international brainstorming session to gather ideas on the concrete direction of the conference. It was the view of this think tank that one aspect of the KEK stood out in particular, namely its political mandate as well as the opportunity to realise it directly through project funding. In 2011, the federal government and the federal states jointly founded the KEK and have since financed it through tax revenues, which the Federal Government Commissioner for Culture and the Media (BKM) and the Cultural Foundation of the German Federal States make available specifically for this task. The federal and state governments thus set the framework for the activities of the KEK; in return, KEK's direct structural feedback to policy-

¹ Michael Fischer's contribution concerns a KEK pilot project funded by the KEK between 2016 and 2018. The recorded presentations of the conference are available at: <https://www.youtube.com/playlist?list=PLvIRySudPW5fecNzz2c-8Pqju-sT8Gb_y> (last accessed 24 April 2024).

makers provides a sympathetic ear for the substantial concerns of its core mandate, which places the coordination of the preservation of written cultural heritage high on the cultural policy agenda, namely at a federal level. In Germany this is not a given especially as, in view of the firmly-established responsibility of the federal states for culture, it required justification; such preservation is a task of national importance, which archives, libraries and other memory institutions cannot fulfil without additional support.

The KEK documented this in 2015 with the publication of the *National Recommendations for Action for the Preservation of the Written Cultural Heritage*.² Based on a systematic survey of the needs in the institutions, these *Recommendations for Action* offer the first comprehensive inventory of the damage and threats to written cultural heritage in Germany, with the result that 63.2 million euros would have to be invested each year to secure at least 1% of the endangered or damaged written cultural heritage. It is abundantly clear from this just how important and effective direct feedback from the KEK to political decision-makers can be. In essence, the aim is to create additional public funds to guarantee the preservation of originals.

In addition to its political affiliation, the KEK is characterised above all by its specialist, interdisciplinary mandate. It is tasked with coordinating the preservation of written material nationwide and thus acts in the interests of all institutions that hold written material, particularly archives, libraries and museums, whose needs in the area of conservation are represented by the KEK at a national level for the first time. The KEK was founded as a ‘coordination’ centre in the true sense of the word, so for it, networking is a priority. Over the past decade, we have initiated several discussion formats to optimise and better synchronise cooperation in the preservation of original documents. We organise the annual Nationwide Expert Meeting where all sixteen federal states and the federal institutions are represented, as well as the Working Meeting of the Archive and Library Departments of the relevant state authorities. In short, we create spaces for the exchange of expertise across states, sectors and organisations and it goes without saying that the KEK, both as a political and specialist interface, always endeavours to create added value for all those involved even if, occasionally, they pursue different ideas. The KEK makes sense as a central institution only if it acts as an amplifier for what concerns everyone involved in the coordinated preservation of written cultural heritage.

² *Die Erhaltung des schriftlichen Kulturguts in Archiven und Bibliotheken in Deutschland: Bundesweite Handlungsempfehlungen für die Beauftragte der Bundesregierung für Kultur und Medien und die Kultusministerkonferenz*. The publication and an English summary are accessible online: <https://www.kek-spk.de/publikationen> (last accessed 24 April 2024).

A highly relevant element in the KEK's public perception are its two funding programmes for the preservation of written cultural assets in their original form. The KEK pilot projects, which are supported by the federal and state governments, have been running since 2010, are broadly based and support not only measures relating to archive or library collections but also projects in the areas of expertise, research, emergency preparedness and public relations. KEK pilot projects thus reflect the cross-sectional task of conservation in all its facets. Funding tends to be small-scale, with the focus on exemplary measures. It is about gaining specialist knowledge, especially in institutions that due to resources lack the specialised knowledge required to maintain their holdings. In this way, experience is gained in projects which in turn can serve as good practice examples for further measures.

With the BKM special programme for the preservation of the written cultural heritage, the KEK has been operating a second funding stream since 2017, which was developed in response to the *National Recommendations for Action*. It uses federal funds to finance large-scale projects, with volume processes such as cleaning, mass deacidification and packaging eligible for funding. This requires 50% co-financing per project, which creates incentives for the federal states to support the institutions with additional funds and to either strengthen corresponding federal state programmes for the preservation of originals or to set them up in the first place. The BKM special programme is the right funding instrument to get closer to the target of the *National Recommendations for Action*: to secure at least 1% of the endangered or damaged written cultural heritage per year. Both funding streams, the KEK pilot project funding and the BKM special programme, complement each other perfectly and offer an impressive overall balance. To date, around 23.8 million euros have been awarded to almost 1,070 projects across Germany for the preservation of originals.

Finally, the KEK portal should be included in an outline of the KEK. Here, we provide information on every funded project and thus offer a unique data pool on 'preservation put into practice' in Germany; all projects are indexed, and the data can be visualised and statistically evaluated. Entirely independently of the funding projects, we are developing the KEK portal into a centralised specialist entry point to the topic of the preservation of originals, covering completely different areas in a glossary that collects the technical terms in alphabetical order from 'abrasion' to 'wrinkle'. In the knowledge network the terms can also be discovered in a playful way as it visualises the interconnectedness of specialist terms from very different areas of knowledge. The specialist information provides access to both introductory and in-depth contributions from the interdisciplinary spectrum of subjects related to the preservation of originals which as a cross-sectional task requires a broad range of knowledge. The basics of professional storage and emergency precautions are just as much part of it as specialist knowledge regarding the restoration of medi-

eval manuscripts. After all, preservation is a comparatively young science and the need for information is correspondingly great and dynamic; the portal will thus continue to evolve as a work in progress.

Overall, the KEK is quite unique, even by international standards: a national interface developed by the federal and state governments with funding powers that establishes, maintains and further develops a transparent, goal- and outcome-orientated exchange between specialists, archives, libraries and policymakers.

In the spirit of this advancement, the KEK conference offered a first opportunity to broaden the view and enter into an international exchange on the cross-disciplinary and cross-institutional areas of the preservation of written cultural heritage. This collection of conference proceedings brings together the contributions of almost all the speakers, with their presentations revised for publication.³ We are indeed grateful for this, all the more so as the bond between speakers in November 2021 could not be strengthened by an in-person get-together; because of the pandemic we had to move the conference to a digital-only event at short notice.

Alas, it is not possible to reflect Shelly Kupferberg's brilliant moderation of the actual conference. A thematic introduction to *Preservation in Perspective* is thus provided by **Richard Ovenden** in his 'The Social Importance of the Preservation of Knowledge', which opens the conference proceedings. Starting with the burning of books by the National Socialists on 10 May 1933 in Berlin, he sheds light on historical as well as contemporary events that involve the deliberate destruction of written cultural heritage, such as the Russian attacks on Ukrainian memory institutions. Ovenden traces the political, social and cultural consequences of the destruction of documents and books in archives and libraries and makes a plea for the important historical and societal task of defending the preservation of knowledge and safeguarding it for future generations.

The subsequent contributions to the conference proceedings are arranged in four thematic sections. The first part, **International Initiatives and Cooperation**, focuses on the added value of international alliances and initiatives. This begins with **Susann Harder**'s text 'Protecting Culture in Crisis – International Cooperation for the Protection of Cultural Heritage in the Context of the Blue Shield' which presents the work of Blue Shield, a non-governmental organisation, which campaigns internationally for the protection of cultural assets in armed conflicts and disaster situations. With reference to Blue Shield's involvement after the explosion in the port of Beirut in 2020 or the floods in Central Europe in July 2021, the organisation's future potential for action at national and international level is outlined.

³ We would also like to thank Anna Czajka (Polish State Archives/Central Archives of Historical Records, Warsaw) and Floriana Coppola (University of Ljubljana) for their contributions to the conference.

The article by **Johanna Leissner**, ‘The Climate Crisis and Its Impact on Our Cultural Heritage – “Strengthening Cultural Heritage Resilience for Climate Change”: A Survey in Europe by the EU OMC Expert Group’, emphasises the immense challenge that climate change poses for the preservation of cultural heritage. Based on the survey she presented of the European Open Method of Coordination (OMC) expert group, she emphasises the need for international cooperation and stronger interdisciplinary collaboration in order to develop sustainable solutions for the future protection of cultural property.

This is followed by the text by **Jody Butterworth** and **Sam van Schaik**, ‘Reflections on Two Decades of the Endangered Archives Programme’, which concludes this thematic section by focusing on digital forms of archiving that allow for greater international networking in preservation. The article reviews twenty years of work by the Endangered Archives Programme (EAP) which provides funding for the digitisation and archiving of endangered cultural assets and discusses how to deal with the challenges of digital preservation and ethical debates in the context of open access and the Covid-19 pandemic.

The second part of the book, **Preservation Management and National Strategies**, presents different systematic approaches. This begins with the contribution of **Johannes Kistenich-Zerfaß**, ‘Managing the Preservation of Originals – Aims, Maxims, Instruments’, which is dedicated to the management tasks derived from the *National Recommendations for Action*. As an interdisciplinary cross-sectional task, conservation management ensures sustainable strategies for the planning, prioritisation, implementation and evaluation of measures for the preservation of originals.

Next, in ‘Cooperative Preservation – The Regional Legal Deposit Copy as a Basis for a Mass Deacidification Strategy’, **Michael Fischer** deals with the coordination proposed by the *National Recommendations for Action* for the original preservation of deposit copies in German libraries. In the libraries’ catalogue systems, the deposit copies must first be identified among the surviving copies and designated as archive copies so that they can be given priority when it comes to measures to preserve the originals, for example mass deacidification.

The text by **Agnes Blüher** and **André Page**, ‘Mass Deacidification at the Swiss National Library’, then describes the systematic deacidification of library and archive collections in Switzerland between 2000 and 2014. In addition to the selection of suitable processes, part of the quality assurance was the monitoring of the deacidified stocks over seven to twenty years, which confirmed the sustainability of the method.

Marie Vest’s text on ‘Preservation at the Royal Danish Library – Achievements and Future Perspectives’, which concludes this thematic section, presents the preservation strategy of the Danish National Library. The method developed is an alter-

native to mass deacidification and is based on storage in cool climate zones adapted to the material and its state of preservation.

The third part of these conference proceedings, **Digital Strategies: Opportunities and Synergies**, addresses possible applications of new technologies in preservation. It opens with a contribution by **Ulrich Fischer** on the ‘Digital Reconstruction of the Cologne Fragments – How, with the Help of AI, “Cologne Flakes” Are Turned Back into Complete Items’. The chapter describes the use of artificial intelligence to reassemble the heavily fragmented archival documents recovered after the collapse of the Historical Archive of the City of Cologne in 2009.

‘Simulating the Effect of Preservation Options – Are Archives More Complex than Rockets?’ by **Cristina Duran Casablancas**, **Josep Grau-Bové** and **Matija Strlič** then looks at the potential of new technology. The authors present a model that not only depicts original preservation as a complex system but also helps to assess the effect and sustainability of preservation measures by taking into account various factors such as the method of preservation, the materiality and character of the collection and environmental factors.

Next, **Ville Kajanne**’s text on ‘Disposal of Documents After Mass Digitisation’ addresses the technical challenges of the large-scale digitisation of documents in Finland, discussing the selection process for eligible holdings and materials as well as the qualitative requirements for the digitised material and the subsequent disposal procedures.

The final contribution to this thematic section is by **Oliver Hahn**, **Carsten Wintermann** and **Uwe Golle** on ‘Multispectral Analysis of Paper Objects – The Amalgamation of Archaeometry and Conservation’. Here the authors explore how the imaging method of multispectral analysis can make visible preliminary drawings, erased areas and revisions in prints and manuscripts and analyse the drawing and writing materials used, thus providing important insights for art historical research, palimpsest research and the development of sustainable conservation and restoration strategies.

The fourth and final part of the book, **Sustainability and Resource Management**, addresses sustainability in the methods and strategies for the preservation of originals. This opens with ‘Sustainable Conservation of Collections – The Push for Passive’, where **Chris Woods** discusses the sustainability of storage conditions and climate monitoring, scrutinising the functionality and future viability of air conditioning systems (HVA) which are expensive to purchase and maintain and also have a limited lifespan of around twenty years before they need to be replaced.

Next, ‘Sustainable Paper – A Challenge for Preservation?’ by **Stephanie Preuss** focuses on the preservation of media from sustainable book and paper production through a discussion of the implications and innovations for preservation and uses

the modern collection of the German National Library to analyse the resulting consequences for conservators and curators.

Jacob Nadal's contribution, 'The Library of Congress Preservation Directorate – Fiscal and Organisational Sustainability', concludes the conference proceedings with a focus on sustainability in library management. This considers how, in 2017 and 2021, the Library of Congress carried out extensive restructuring and studies on overall costs and areas of expenditure to enable the Preservation Directorate to respond to new requirements in an agile manner across strategic planning cycles and to implement extensive projects in the area of preservation.

And where are we now, more than two years after the international conference 'Preservation in Perspective'? The framework conditions have become tougher since in addition to the recent pandemic the global political situation has brought into focus issues such as the security of electricity and gas supplies as well as resource scarcity and associated price increases. Topics such as mass deacidification, resource-conserving storage and digitisation remain highly relevant and must be kept in mind in order to ensure the sustainability of the preservation of originals.

Specifically, the importance and necessity of preserving the original is anchored in the *German Strategy for Strengthening Resilience to Disasters* published by the Federal Ministry of the Interior in July 2022: 'Cultural assets are unique testimonies to the past and present. They represent values and traditions, convey knowledge and create identity'.⁴ Accordingly, since 2023, the KEK has focussed strongly on emergency preparedness as a measure to protect cultural assets in its pilot project funding. This targeted funding can support institutions and emergency response networks in implementing disaster risk management and therefore we would like to thank our sponsors at federal and state level. By making public funds available, the Coordination Office is able to secure the written cultural heritage in Germany in a resource-efficient and sustainable manner for the future.

⁴ *German Strategy for Strengthening Resilience to Disasters: Implementing the Sendai Framework for Disaster Risk Reduction (2015–2030) – Germany's contribution 2022–2030*. Published by the Federal Ministry of the Interior and Community (BMI), Berlin 2022, 61. https://www.bbk.bund.de/SharedDocs/Downloads/EN/Mediathek/Publikationen/german-strategy-resilience-long-eng_download.pdf?__blob=publicationFile&v=3 (last accessed 24 April 2024).



Fig. 1: Due to the COVID-19 pandemic, the conference was held mainly digitally. However, the KEK team and some speakers were on site at the James-Simon-Gallery on Museum Island in Berlin. Photo: KEK, Timm Wille



Fig. 2: The KEK team had prepared various conference materials for the participants on site. Photo: Berlin State Library, Carola Seifert



Fig. 3: The director of the KEK, Ursula Hartweg, introduced the participants to the conference programme. Photo: Berlin State Library, Carola Seifert



Fig. 4: In a conversation with moderator Shelly Kupferberg, Barbara Schneider-Kempf, former Director General of the Berlin State Library, and Isabel Pfeiffer-Poensgen, then Minister for Culture and Science in North Rhine-Westphalia, talked about the beginnings of the KEK. Photo: Berlin State Library, Carola Seifert



Fig. 5: Matija Strlič, who holds a Chair in Cultural Heritage Studies at University College London, spoke about international research infrastructures for libraries in the European Union. Photo: KEK, Björn Schmidt



Fig. 6: All presentations were interpreted by Gisela Tantsch and Karolina Golimowska (left). The KEK team (right) provided digital support for the event. Photo: Berlin State Library, Carola Seifert



Fig. 7: In the closing session, Shelly Kupferberg, Matija Strlič, Ursula Hartwig, Johannes Kistenich-Zerfaß, Vile Kajanne and other speakers discussed strategies for the future of preservation. Photo: KEK, Björn Schmidt



Fig. 8: As a greeting, the attendees received a chocolate bar in a preserving jar, symbolising the theme of conservation. Photo: Berlin State Library, Carola Seifert



Fig. 9: Shelly Kupferberg presents a preserving jar to Hermann Parzinger, President of the Prussian Cultural Heritage Foundation and host at the James-Simon-Gallery. Photo: Berlin State Library, Carola Seifert

Richard Ovenden

The Social Importance of the Preservation of Knowledge

On 10 May 1933, a bonfire was held on Unter den Linden, Berlin's most important thoroughfare, close to the Berlin State Library (Figure 1). It was a site of great symbolic resonance: opposite the university and adjacent to St Hedwig's Cathedral, the Berlin State Opera House, the Royal Palace and Karl Friedrich Schinkel's beautiful war memorial. Watched by a cheering crowd of almost forty thousand, a group of students ceremonially marched up to the bonfire carrying the bust of a Jewish intellectual, Magnus Hirschfeld, founder of the ground-breaking Institute of Sexual Sciences. Chanting the 'Feuersprüche', a series of fire incantations, they threw the bust on top of thousands of volumes from the institute's library, which had joined books by Jewish and other 'un-German' writers (gays and communists prominent among them) that had been seized from bookshops and libraries. Around the fire stood rows of young men in Nazi uniforms giving the Heil Hitler salute. The students were keen to curry favour with the new government and this book-burning was a carefully planned publicity stunt. In Berlin, Joseph Goebbels, Hitler's new minister of propaganda, gave a rousing speech that was widely reported around the world:

No to decadence and moral corruption! Yes to decency and morality in family and state! ... The future German man will not just be a man of books, but a man of character. It is to this end that we want to educate you ... You do well to commit to the flames the evil spirit of the past. This is a strong, great and symbolic deed.

Similar scenes went on in ninety other locations across the country that night. Although many libraries and archives in Germany were left untouched, the bonfires were a clear warning sign of the attack on knowledge about to be unleashed by the Nazi regime. That regime would move this act of destruction from the merely theatrical to the industrial scale and it has been estimated that over 100 million books were destroyed during the Holocaust in the twelve years from the period of Nazi dominance in Germany in 1933 up to the end of the Second World War.

Article note: The following account is based on: Ovenden, Richard (2020). *Burning the Books: A History of Knowledge Under Attack*, London: John Murray, also published in German in 2021 as *Bedrohte Bücher: Eine Geschichte der Zerstörung und Bewahrung des Wissens*, Berlin: Suhrkamp Verlag. The book version contains all relevant literature and source references.

Richard Ovenden, Bodley's Librarian, Bodleian Libraries, University of Oxford



Fig. 1: Book burning on the Opera Square in Berlin on 10 May 1933. Bundesarchiv, image 102-14597. Photo: Georg Pahl, CC-BY-SA 3.0

But the staged book-burnings provoked a response among those who saw the need to defend the freedom of expression; in fact, two new libraries were formed as a counterblast. A year later, on 10 May 1934, the Deutsche Freiheitsbibliothek (German Freedom Library, also known as the German Library of Burned Books) was opened in Paris. Founded by German-Jewish writer Alfred Kantorowicz with support from other writers and intellectuals such as André Gide, Bertrand Russell and Heinrich Mann (the brother of Thomas Mann), the library grew rapidly, collecting over 20,000 volumes, not just the books which had been targeted for burning in Germany but also copies of key Nazi texts, in order to help understand the emerging regime. The writer H. G. Wells was happy to have his name associated with the new library which became a focus for German émigré intellectuals and organised readings, lectures and exhibitions, much to the disgust of German newspapers. Following the fall of Paris in 1940, the library was broken up, with many of the volumes joining the collections of the Bibliothèque Nationale de France. The Brooklyn Jewish Center in New York had established an American Library of Nazi-Banned Books in December 1934, with noted intellectuals on its advisory board including Albert Einstein and

Upton Sinclair, and was proclaimed as a means of preserving and promoting Jewish culture at a time of renewed oppression.

The 10 May 1933 book-burning was merely the forerunner of arguably the most concerted and well-resourced eradication of books in history through almost two decades of attacks on knowledge in libraries and archives, both private and institutional. These attacks on knowledge were a cultural and intellectual genocide that prefigured the human genocide that would soon follow. The Nazis, however, have not been alone over human history among authoritarian regimes in targeting knowledge – either through misinformation, destruction or theft. This is a phenomenon that continues to this day and in the digital age.

Destruction can take many forms, one of which is the assault on truth. A key trigger of this in recent times was the assertion in January 2017 by Kellyanne Conway, President Trump's Press Secretary, that against the evidence (publicly available facts) that fewer people attended Trump's inauguration than had attended President Obama's were 'alternate facts' that allowed an opposite view to be held.

The incidents of the destruction of knowledge also helps us see clearly the social importance of the preservation of knowledge. A paradigm example of this in recent times was the destruction of the landing records of the 'Windrush generation' by the UK Home Office in 2010, at the same time that the Home Office were instigating their immigration policy known as the 'hostile environment'. This policy targeted citizens from former British Empire and commonwealth countries who had been invited or allowed to come and work in the UK after the Second World War, but were being challenged to prove through documentation their right to remain. At least 80 of these men and women, many of whom had spent most of their lives in the UK, were unlawfully deported based on the fact that they lacked the documentary evidence to prove their right to remain, whereas in fact the Home Office all this time had possession of the landing cards that could prove their lawful status. This archive of documents was destroyed by the Home Office, an act open to two different interpretations – was it simply to create more space or was it to deprive those being targeted by the policy of documentation that might have been helpful? Attacks on knowledge have a long history. Examining that history tells us much about the crucial role of knowledge in a healthy, open society and the place of institutions – libraries and archives – that society has entrusted the role of preserving knowledge to.

The British Museum's wonderful exhibition in 2018, 'I Am Ashurbanipal', had a library at its heart – perhaps the earliest we know of that attempted to hold the entirety of recorded knowledge known at the time. It is the surviving library of Ashurbanipal, King of Assyria, dating from the seventh century BCE, and formed of clay tablets marked with cuneiform script. The library of Ashurbanipal is the best known of many libraries and archives that survive from the ancient civilisations of

Mesopotamia, institutions dating back five millennia that were also formed through acts of destruction and deliberate theft.

There are accession records for Ashurbanipal's library which have been studied by scholars working in this field which show that he was deliberately targeting libraries and archives in neighbouring states – especially Babylonia – by sending his agents either forcibly or through diplomacy to seize documents from these other libraries in order to build his own knowledge base up. Part of the content of these ancient libraries concerned predictions about the future, about astronomy, astrology and divination, a theme that recurs in the digital age.

If you are able to remove knowledge from your enemy you can not only make them weaker but also make yourself stronger. Our knowledge of these libraries and archives has emerged since the middle of the nineteenth century, when a series of excavations were begun by French archaeologists. A British explorer, Austin Henry Layard, who was deeply interested in antiquities, undertook ground-breaking excavations in the ancient capitals of Nimrud and Nineveh in what is now Iraq and brought tens of thousands of tablets, the contents of these ancient libraries and archives, back to the British Museum. He was known as 'the lion of Nineveh' and became famous and wealthy at the time.

One cannot discuss attacks on knowledge in the ancient world without making reference to the Great Library of Alexandria. For millennia, the greatest library in the ancient world has been assumed to have been destroyed in a catastrophic conflagration; the ancient writers were in fact divided on even the basic issues of the Library, including its size and the causes of its demise. All they really agreed on was that it was larger than any other library they knew of and that great scholars came to work there such as Euclid, the founder of modern mathematics who wrote the *Elements of Geometry* (Figure 2) while working at the great library. What modern scholars now agree on is that the library did not go up in flames in a single terrible event but declined slowly, over a long period of time, reduced to nothing through neglect and under-funding so that by the fourth century of the Christian era the library was completely gone, just a memory.

Moving forward in time, one of the most momentous periods for the destruction of knowledge was the Reformation of the sixteenth century. One person, John Leland, was instrumental in both destruction and preservation of knowledge in England at the time. He was an astonishing character who doesn't feature in Hilary Mantel's great trilogy about Thomas Cromwell and Henry VIII but really ought to have. Educated both at Cambridge and Oxford and then later at the University of Paris, he became steeped in humanism and very interested in investigating primary sources of the past. Henry VIII tasked him with a 'most gracious commission, to peruse and most diligently search all the libraries' of the monasteries and colleges in the country as part of the King's so-called 'Great Matter', the search for informa-

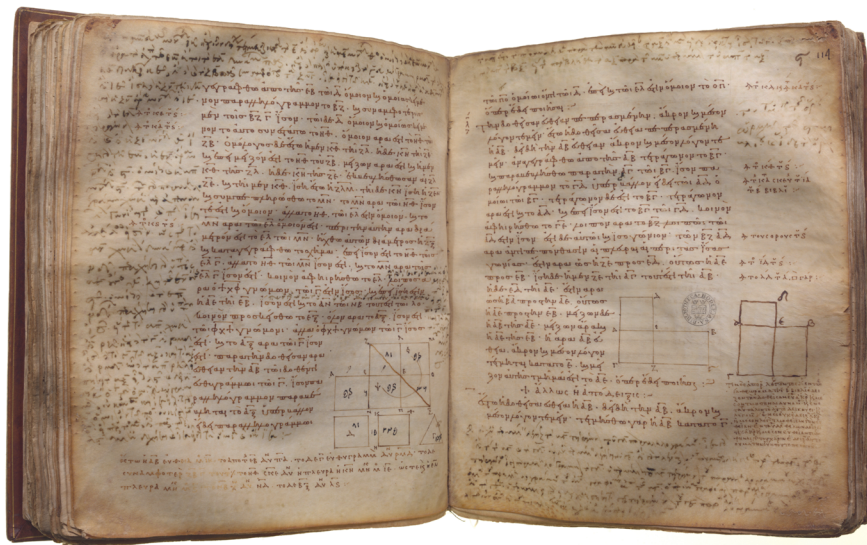


Fig. 2: Euclid, *Elements*, Constantinople, CE 888. Bodleian Library, MS. D'Orville 301, fols. 113v–114r. Photo: Bodleian Libraries, University of Oxford, CC-BY-NC 4.0

tion to help him win his case for the divorce of Catherine of Aragon, to enable him to marry Anne Boleyn and later to argue for the divorce of the whole country from Papal authority.

We are fortunate in the Bodleian Libraries to have the archive of John Leland. In these papers one can find maps of his journeys, the so-called itineraries. These are extraordinary documents listing the places he visited, sometimes with maps that he drew to help plan the journeys containing detailed notes of the books that he saw. Leland's archive provides an extraordinary snapshot of the medieval libraries of Britain on the eve of the Reformation even though he didn't realise that through his research visits he was party to their destruction.

In 1533, Leland visited Glastonbury Abbey. In size it was actually bigger even than Canterbury Cathedral and it was of course a great pilgrimage site with associations to the mythical King Arthur, to Merlin and to Joseph of Arimathea. It thus attracted great wealth such as through many donations from pious pilgrims and also built up an extraordinary library. It was one of the libraries that Leland was most excited to go to visit.

Leland actually gives us a description of his visit to the library in 1533 or 1534. 'I had hardly crossed the threshold' he wrote, 'when the mere sight of the most ancient books left me awestruck, stupefied'. He literally swooned just at the mere sight of the ancient books in the library and he became great friends with the

elderly Richard Whiting, the last Abbot of Glastonbury. He recalls in his notes how generous Whiting was in showing him books and giving him hospitality in his visit and he even left us notes of the books that he looked at. Some of them were ancient chronicles which were to help prove that there was a viable Church in England before the Norman Conquest, indicating the antiquity of an alternative to Papal authority. He also found there many sources which helped him unearth the history of King Arthur, such as a book there which he was greatly interested in. It is documented in a list of the books he saw in 1533 and reads: ‘grammatica Euticis liber olim Sancti Dunstani’. It is now known as *Saint Dunstan’s Class Book* (Figure 3) and is a miscellany of texts dating from the ninth to the tenth century, three of which were almost certainly owned or used by St Dunstan, Abbot of Glastonbury, and then later Archbishop of Canterbury, a very important figure in the reform and modernization of the Church in England in the ninth century.

What happened next was absolutely tragic for the library of Glastonbury Abbey. In 1539, the Act for the Suppression of the Greater Monasteries was passed which set up a series of visitations by commissioners appointed by the King to pursue the task of dissolution. The commissioners visited Glastonbury Abbey where they presented trumped-up charges against Abbott Whiting that he ‘robbed the Church of Glastonbury of treasure’. He was duly tried, convicted and sentenced to death. He was then dragged through the town and taken up to Glastonbury Tor, the famous hill behind the Abbey, where he was hung, drawn and quartered, with parts of his body placed in neighbouring towns: Wells, Taunton and Glastonbury itself. The monastery itself was then dismantled and the books either destroyed or dispersed.

We don’t know exactly how many books were in the library between 1533 and 1534 when Leland visited, but the medieval catalogue of 1249 allows us to estimate that there were at least 1,500–2,000, with a mere sixty volumes known to survive today. A similar fate befell the other medieval religious libraries of Britain, none of whom escaped the Reformation intact. What happened to the books? From contemporary accounts we know that many of them were torn up and sold, some were bought by grocers and soap sellers according to Leland’s friend John Bale and some were sold to book binders to strengthen bookbindings. These volumes ceased to have value other than as waste material and it is therefore remarkable that we have even a small number of books from the medieval library at Glastonbury (as well as from other medieval libraries). Those that have survived are with us now thanks to the activities of antiquaries and many of these antiquaries became part of a reaction against the destruction of knowledge during the Reformation.

A similar fate befell the books in the library of my own institution, the University Library in Oxford. Originally founded in 1320 by Thomas Cobham, Bishop of Worcester, in a room in the University Church specially constructed for the purpose of a library, it grew during the middle ages through numerous gifts, espe-



Fig. 3: *St Dunstan's Classbook*. Bodleian Library MS. Auct. F. 4. 32, fol. 1r. Photo: Bodleian Libraries, University of Oxford, CC-BY-NC 4.0

cially a spectacular one in the middle of the fifteenth century from Humfrey, Duke of Gloucester, one of the most powerful laymen in the country, someone deeply interested in humanistic learning. In order to make room for almost 300 new books from Duke Humfrey's gift, the University authorities built a new library – a beautiful space, still called Duke Humfrey's Library today – which first opened to readers in 1488. But this library was destroyed in the second phase of the Protestant Reformation by the commissioners of Edward VI in 1549–1550. Again, the books were mostly sold for scrap materials and only a handful escaped with Catholics fleeing to Continental Europe.

What followed was a reaction against this wholesale and ideologically driven destruction of knowledge. Sir Thomas Bodley, from a staunchly Protestant family, an



Fig. 4: John James Halls, *Rear Admiral Sir George Cockburn at the burning of Washington*, ca. 1817, oil on canvas, 239 × 148.5 cm. National Maritime Museum in Greenwich, London. Photo: Public Domain

Oxford graduate, someone who had considerable private wealth and who was well connected in the Court of Elizabeth I, came along in the 1590s and set about re-establishing the library. His refounding of the library had significant special features, with the founding statutes of the library placing preservation absolutely at the heart of the library's mission, as well as access. Making knowledge available to what Sir Thomas called 'the whole republic of the learned' was key – the library was one of the few open to scholars from outside the University and the Bodleian published a catalogue of its holdings as early as 1605. Bodley, moreover, directed all of his funding, his own wealth, to endow the library to provide for 'officer's stipends, the augmentation of books and other pertinent occasions'. He wanted his institution to endure and not to suffer, as he had seen the fate of so many libraries during the Reformation.

The nineteenth century saw another episode of the destruction of knowledge, the burning of the Library of Congress in 1814 (Figure 4). This was the result of a military intervention led by Rear Admiral Sir George Cockburn who led a British expeditionary force to the United States, a part of the war of 1812–1814.

There is an eye-witness account of the burning of Washington by George Gleig who wrote: 'I do not recollect to see more striking or sublime than the burning of Washington'. He also was rather ashamed that the troops of which he was one also set fire to 'a noble library, several printing offices and all the national archives which were committed to the flames, which might better have been spared', so he later admitted.

The library, the only one in the city, was housed in the Capitol building, the only stone building in the city at the time, which housed the Senate and the House of Representatives as well as the office of the President. The Library of Congress had been founded in 1800, the first librarian appointed a few years later and the collections had been slowly built up to the point in 1814 that the 5,000 or so volumes provided a very useful set of combustible materials to start the fire. One of the books from the building was saved – not from the Library of Congress but from the office of the President – and taken as a souvenir by one of the British troops who regarded it as the 'spoil of the conqueror' and gave it to Cockburn. It was eventually restored to the Library of Congress by A. S. W. Rosenbach, the great rare book dealer, in 1940.

What happened after the events of August 1814 was another response to destruction and a further indication of that human impulse for preservation and renewal. That response came from Thomas Jefferson, one of the founding fathers of the United States and a former president, who had retired to his estate at Monticello in Virginia where he heard about the fire and wrote an absolutely scorching letter to a national newspaper in Washington saying that this was an act of barbarism and he offered his own library, the greatest private book collection in the United States at the time, to be purchased by Congress at favourable rates to replace the lost library. After months of political wrangling, Congress eventually agreed to the purchase and Jefferson ended up selling six and a half thousand volumes for the princely sum of twenty-four thousand dollars; quite an enormous sum at the time but which gave the new Library of Congress a head start, with vital books for government to use to help it manage its national affairs. Unfortunately, this library then suffered another accidental fire in 1851, the result of which was that Congress voted for much bigger funds to rebuild the Library of Congress and make it the great institution that it is today. However, the burning of the library remained an important part of the national myth of the United States long into the nineteenth century.

Almost exactly a century on from the destruction of the Library of Congress there was another noteworthy attack on knowledge which became an international incident in the way that the burning of the Library of Congress really didn't: the destruction of the Library of the Catholic University of Louvain in August 1914. Soon after the start of the First World War, the German army marched into neutral Belgium where they occupied the beautiful, ancient city of Louvain (modern day Leuven), which many called the 'Oxford of Flanders' because of its combination

of attractive ancient architecture and the famous University. In August 1914, the German troops set fire to the historic centre of the city and indeed started it in the university library which was quickly destroyed, with almost all the collections incinerated. The University library dated back as an institution to the 1630s and was refounded in 1835, becoming one of a number of legal deposit libraries for the (then) new country of Belgium. The attack on knowledge that the burning of the library represented prompted an international outrage; all over the world the news of the burning of the library was met with dismay and horror.

Although this episode in the First World War has for the most part been forgotten today, at the time it was a huge story. The burning of the library was viewed as a crime against the world and the destruction of the Library of Alexandria was evoked to give a sense of the scale of the loss, however, one of the interesting things about this story was the reaction to the great conflagration. An international movement to raise funds and to donate books to give to the library was begun, with a special clause in the Treaty of Versailles written whereby Germany was charged with replacing the destroyed books. The Americans took the library's renewal as an opportunity for projecting soft power in Europe after the First World War, with a committee charged with raising the funds necessary to rebuild the physical structure of the library, chaired by Nicholas Murray Butler, the President of Columbia University.

Butler's committee chose an American architectural practice, Warren and Wetmore, to design the new library, and they designed a pastiche or facsimile of the original building in the Low Countries vernacular style. A motto soon became associated with the promised building: 'Destroyed by the Germans in 1914. Restored by America in 1922'. Despite the ambition, it took Butler's committee much longer to raise the money than they had originally planned, with John D. Rockefeller eventually supplying the shortfall himself. By the time that they finished raising the money, in the late 1920s, the post-war diplomacy between Belgium and Germany had begun to see a burying of the hatchet, so to speak, and the acts in Louvain in 1914 began to be purposefully ignored or downplayed by Belgians.

The Americans intended a grand opening ceremony for the rebuilt library with a massive plaque laying out the motto in Latin, that the building was destroyed by the Germans and rebuilt by the Americans, which became a national point of tension. The American architect put this plaque up several times and local Belgians climbed up in the middle of the night and smashed the plaque because they didn't want it to colour the relations that they had with their neighbours. Eventually the plaque was removed and placed in a war memorial and the library was finished: rebuilt and modernised.

The Louvain Library was incredibly important to Belgium as a kind of national symbol – a place of culture but also a place of learning by the young, an institution,

therefore, dedicated to the future. There was a great effort to rebuild the library and to restock it with books, an international effort that was supported by libraries and readers all over the world as well as by librarians – the national campaign in Britain was led by Henry Guppy, the librarian of the John Rylands Library in Manchester. Sadly, however, in 1940 the library was destroyed a second time, again by the German army, who targeted it with artillery fire. The library was rebuilt after the Second World War, once again.

The Holocaust was one of the episodes in history where the greatest amount of destruction of knowledge took place. Vilna, or modern day Vilnius, in Lithuania at the beginning of the twentieth century was one of the great centres of Jewish civilization in Eastern Europe: a city full of libraries, archives and learned Rabbis. The Strashun Library, for example, had been formed by a bibliophilic Jewish businessman at the end of the nineteenth century, and left to the Jewish community in Vilna. On the eve of the Second World War, it had a busy reading room and a learned librarian (Figure 5), but Vilna also had a great archival institution, a research institute into Yiddish culture, into the cultural life of everyday Judaism in Central and Eastern Europe, called YIVO. YIVO from its foundation in 1922 began to collect materials that documented everyday life of the Jewish communities in central and Eastern Europe: oral histories, music hall posters, documents such as medical case notes and even the diaries of Theodor Herzl, the founder of Zionism. In 1939 Poland, Lithuania and the other Baltic States were divided between Germany and Russia; then, in 1942, the Germans invaded and occupied Vilna, seizing the Jewish library and archive collections in the city.

Just behind the Blitzkrieg came an operational group, established and run by a librarian, Johannes Pohl. The group, called the Einsatzstab Reichsleiter Rosenberg, was tasked with identifying books and documents from the seized Jewish libraries and archives which were to be sent back to Frankfurt to the 'Institute for the study of the Jewish question' established by Alfred Rosenberg, the chief strategist of Anti-Semitism in Nazi Germany. What was not chosen to be sent to Frankfurt would be sent to local paper mills for destruction.

The Nazis forced the Jewish community of Vilna to live in the ghetto, and they identified a number of former librarians and archivists and other intellectuals to undertake the horrible task at gunpoint of sorting through these seized libraries and archives. Such a task must have been incredibly difficult with their own history and culture either being sent to Germany or to be destroyed. The Jews who were selected for this task became known as the 'Paper Brigade'.

The human impulse toward preservation can be identified in the actions of the 'Paper Brigade' (Figure 6). They smuggled items from the collections they were forced to sort through back into the ghetto every day and they hid these books and documents inside the ghetto itself in the hope that one day they could be recov-



Fig. 5: Khaykl Lunski in the Strashun Library in Vilnius, 1930. Center for Jewish History Digital Collections: YIVO, via Europeana. Photo: Public Domain



Fig. 6: Three members of the ‘Paper Brigade’ pose together on a balcony in the Vilna ghetto. United States Holocaust Memorial Museum Photo Archives #64900. Courtesy of the Sutzkever Family. Copyright of United States Holocaust Memorial Museum

ered. Each time they did this they risked their own lives, displaying a compulsion to preserve their own culture, their own documentary witness to their community, to their civilisation, in the hope that they would survive the Holocaust and the documents could speak of the lives they had before the war.

A few of the members of the ‘Paper Brigade’ managed to escape when the Vilna ghetto was liquidated in 1944 and joined Partisans in the forests. With the Soviet army they liberated Vilna and retrieved some of the collections – tens of thousands of documents that they had managed to hide.

This effort to preserve the documentary heritage – witnesses of Jewish life – did not just happen in Vilna; it was undertaken in other centres in Eastern Europe as well. In the Warsaw ghetto an archive was made by an organisation called ‘Oyneg Shabes’, led by an extraordinary man called Emanuel Ringelblum who was murdered when the Warsaw Ghetto was liquidated, but only after he had managed to hide and bury documents which he and his fellow members had saved. These were dug up afterwards in metal cartons and milk canisters (Figure 7).

Some of the documents which had found their way from Vilna to Rosenberg’s Institute in Frankfurt were seized by American forces in 1945 and eventually sent



Fig. 7: One of the milk cans used to hide documents. From the Ringelblum ‘Oyneg Shabbos’ Archive. Photo: Public Domain

back to a branch of the YIVO Institute in New York in 1947. Meanwhile, back in Vilna, the materials that had been saved by the ‘Paper Brigade’ and then sent for destruction again by the Soviets were saved a further time, this time by a Lithuanian librarian called Antanas Ulpis who preserved these documents by going to the paper mills and turning the trucks around and driving one of them back himself. He hid them in a church that had been requisitioned as one of the storage sites for the new National Library of Lithuania and also hid the documents in organ pipes in other locations; they were only revealed after Ulpis’s death in 1989 as the iron curtain came down. They are now one of the great treasures of the National Library of Lithuania and are being digitised by the YIVO Institute in New York.

The attacks on knowledge in Bosnia and Kosovo during the Balkan conflicts following the break-up of the former Yugoslavia is another example of a cultural genocide that came before a human genocide.

The National Library of Bosnia and Herzegovina in Sarajevo was deliberately attacked by the Serb militia besieging the city with incendiary shells; no other buildings were targeted on that day, 25 August 1992. The fire brigade and librarians that tried to rescue collections from the burning building were shot at by snipers, but if you look at the western newspapers at the time you will find that the attack on the library didn't even get onto the front pages. The story was buried inside with very brief accounts, much briefer than stories about the last bear in the Sarajevo Zoo. The library was attacked because it was a living institutional symbol of the multicultural community that Sarajevo and Bosnia had managed to create in the decades before the wars. It preserved the written culture of Bosnian Muslims, Jews and Christians all living more or less happily together, something which the Serbs deliberately sought to attack through eradicating the Bosnian national memory – the library.

It wasn't just the National Library that was targeted at the time. Provincial archives and land registries were also destroyed by Serbian forces trying to eliminate any record of Muslim land ownership.

A librarian called Andrés Riedlmayer, who has just retired from the Fine Art Library in Harvard, collected evidence for the International War Crimes Tribunal for the Former Yugoslavia as to what had happened to libraries and archives in Bosnia. He even gave evidence at the trial of Slobodan Milošević and for other war criminals like Ratko Mladić. Part of his testimony concerned the cultural importance of the National Library and also the lengths that the Serbs went to in order to destroy the knowledge that it contained.

At this moment in time, we are experiencing a profound shift in the way that knowledge is created, shared and stored. As a society we are outsourcing the storage of social memory to the big technology companies, what the great Oxford historian Timothy Garton Ash calls the 'private superpowers'. What these companies advertise as free services aren't really free – we contribute our usage data, which is then harvested and mined for targeted commercial purposes. We also are seeing an increasing number of incidents of that 'free' storage being terminated as business models are reviewed and people lose access to collections which had been placed there. And of course there are hostile attacks too, where cyber warfare is happening.

The preservation of knowledge is one of the pillars, I would argue, of an open society. But our reliance on the web as a platform for sharing knowledge and even for storing it is very dangerous. We can see this when the Harvard Law Library did a survey a few years ago on the decisions of the Supreme Court in the United States

through the website where all these decisions are now published and found in 2011 that 40% of the links on that website were broken and didn't lead you to anywhere. Access to the laws of the land are of fundamental importance to an open society.

Then in more recent times we've seen the data profiling company Cambridge Analytica actually using the information that we all create every time that we search on a user search engine, use social media services such as Facebook, click 'like' on posts and so on, using it to create digital profiles of us which are traded every day to sell for influencing political agendas. The data harvested and profiled was used to target political advertising through Facebook.

One of the problems faced by society at the moment is that the tech companies do not have preservation in their business model. There is no Facebook archive (for example): we do not know what the political adverts contained that were targeted at Facebook users during the 2016 Presidential elections, for instance. Some libraries and archives are now developing strategies, however, to circumvent this. The National Library of New Zealand for example has a project where they are asking New Zealanders to donate their Facebook profiles in order to gain a picture of how New Zealand society interacted with social media in the twenty-first century.

To give a further indication of the dangers that society faces with the tech industry we should return to the obsession of Mesopotamian civilisations with the prediction of the future. This is what the modern data-driven tech industry is now heavily concerned with – and began with the ad-tech industry trying to predict an individual's future spending habits through profiling their online behaviours. It then moved onto voting intentions and is now focussed on predicting future health through wearable devices such as a Fitbit or Apple watch to track your Digital health, when this data is actually sending information about your health to the private tech companies. The devices and the data they gather can be used by an individual to monitor your vital health statistics but is now being harvested and gathered by those companies to help them predict your future health. Google, for example, has acquired Fitbit, so they can easily match your search history – if you googled the symptoms of heart disease, Google can now match this with your biometric data from your Fitbit. How would you feel if Google sold this information to your health insurer?

It is also possible to see the power of the tech industry to suppress information that might be important for society to understand our contemporary world. In January 2021 a group of insurgents inspired by Donald Trump stormed the US Capitol building in Washington where tragically five people lost their lives that day. We know that they used an encrypted messaging App called Parler to communicate and organise which was quickly taken down from the App stores and from the web. However, a not-for-profit library service called the Internet Archive preserved the Parler Website just before it disappeared so there is a record of it.

Of course, Donald Trump was the first president to use social media to control political communications and he did so incredibly successfully. But he also had a habit of deleting many messages shortly after sending them, which while not a high percentage is still of great significance given how much he relied on Twitter as a platform. Several activist archivist groups set up systems to automatically screenshot each Tweet from Trump and to make them publicly available as a complete record of his social media behaviour. The National Archives of the United States are now using this data on their own Presidential Library site for Trump.

The use of encrypted and self-deleting messaging systems is something I am now very concerned about, as they hide the communication between Government ministers, civil servants and special advisors on matters of great public concern, especially in the formulation of government policy. The public has a right to know the content of these messages if they relate to the business of government. And as such it is my view that they should be handled under the 1958 Public Records Act, as I have argued elsewhere, and the Ministerial Code of Practice needs to be strengthened and parliamentary sanction given greater teeth to ensure we know what our paid officials are doing.

Throughout history, knowledge held by libraries and archives have been targeted for attacks and for religious, political, cultural and ideological motives. The fact that libraries and archives continue to be subjected to hostile action by those seeking to impose authoritarian control on society is a measure of the importance of the work they do. Libraries and archives are nothing less than the infrastructure of democracy and there are five functions that these institutions perform for society that demonstrate this role: firstly, they provide opportunities for education at all levels and for all ages, perhaps the most enduring function of a library, as well as for self-education where – in the case of public libraries – access to knowledge is free for all. Secondly, they provide a diversity of knowledge for society. As John Stuart Mill wrote in *On Liberty*: ‘Only through a diversity of opinion is there, in the existing state of human intellect, a chance of fair play to both sides of the truth’. Libraries especially bring a great diversity of ideas, of knowledge, from different languages to different and often challenging ideas into a community or into society. Thirdly, libraries and archives, and perhaps especially archives, are repositories for the rights of citizens, whether that means the laws of the land or, in the case of land registries, the conformation of property ownership, or in the case of population registries, the facts of citizenship. Fourthly, libraries and archives are, in the world of misinformation and disinformation, reference points for facts and truth where knowledge is preserved, properly provenanced and catalogued and where it is open to the public for verification. Finally, libraries and archives are places where the identities of communities and of society are preserved and made accessible.

As we see in Ukraine at the moment, libraries and archives are the lifeblood of an open, democratic society; Russian attacks on libraries in occupied parts of Ukraine show how much they challenge the authoritarian instinct. We must learn the lessons of the past if we are to support society moving into the future and invest in the preservation of knowledge.



I International Initiatives and Cooperation

Susann Harder

Protecting Culture in Crisis – International Cooperation for the Protection of Cultural Heritage in the Context of the Blue Shield

Abstract: The Blue Shield is an international non-governmental organisation which endeavours to protect cultural heritage in times of crisis. While the main context of the organisation is cultural property protection during armed conflict in accordance with the 1954 Hague Convention, Blue Shield International and its now 31 National Committees have also been active in providing first aid to cultural heritage as well as supporting heritage institutions after major disasters. Following a brief introduction of the organisation the paper will focus on a number of relief measures for cultural heritage sites that the Blue Shield has provided in recent years. Most notably, this will include activities in response to damages after the floods in central European countries in July 2021 and the blast at the Beirut port in August 2020. Thereby, it will illustrate the support the Blue Shield – as a non-governmental organisation and actor of civil society – can deliver in such scenarios, both on the national and international levels.

1 The Blue Shield – In Germany and Around the World

‘Protecting culture in crisis’ is the by-line of the Blue Shield’s logo and, at the time same, the organisation’s core mission. The Blue Shield was founded in 1996 originally as the International Committee of the Blue Shield, uniting four international organisations which are engaged in the conservation of cultural heritage. These so-called ‘Founding Four’ are the International Council of Museums (ICOM), the International Council for Museums and Sites (ICOMOS), the International Federation of Library Associations and Institutions (IFLA) and the International Council on Archives (ICA).¹ Within the framework of the International Committee, they wanted to combine their respective expertise to support the drafting process of the Second

1 For further information about the history of the Blue Shield, see Varlamoff 2002; Stone 2017.

Susann Harder, Blue Shield Germany

Protocol to the Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict. The name ‘Blue Shield’ was derived from the distinctive emblem of this convention.²

The Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict (adopted in 1954, hereafter abbreviated as 1954 Hague Convention) was the first global convention aimed at the protection of cultural property. Since its adoption, however, it has not been implemented well by the High Contracting Parties and as a result its protection mechanisms have been ineffective throughout several armed conflicts, such as the Six-Day-War and the subsequent occupation of territory by Israel³ and the Cambodian-Vietnamese War.⁴ During the Post-Yugoslavian Wars in the 1990s the massive destruction of cultural property again exposed the weaknesses of the 1954 Hague Convention.⁵ As a result, the High Contracting Parties decided to formulate a Second Protocol.⁶

When adopted in 1999, the International Committee of the Blue Shield and thereby its successor Blue Shield International established in 2016 was explicitly recognised as an advisory organisation in the Second Protocol. Article 27 (3) states: ‘To assist in the implementation of its functions, the Committee may invite to its meetings, in an advisory capacity, eminent professional organisations such as those which have formal relations with UNESCO, including the International Committee of the Blue Shield (ICBS) and its constituent bodies.’⁷

The union of the ‘Founding Four’ created one of the defining aspects of the Blue Shield’s identity and way of working, namely that of a network. It showcased the understanding that the protection of cultural property in crises requires such a diversity of expertise and the capacity to act that cannot be generated by one organisation alone, but only in close cooperation with others.

Following the example of the founding organisations, the first national committees were established, for example in Belgium, France, Poland and the Neth-

2 The emblem is defined in Article 16 of the 1954 Hague Convention. In Article 17, its use is clearly stipulated: it marks cultural property protected under the Convention, as well as personnel responsible for its protection and transport. For the full text of the 1954 Hague Convention, see the website of UNESCO, <<https://en.unesco.org/protecting-heritage/convention-and-protocols/1954-convention>> (last accessed 13 March 2023).

3 See Mizrachi 2015.

4 See O’Keefe 2006, 153–154.

5 For example, the destruction of the bridge at Mostar and the bombing of Dubrovnik, see O’Keefe 2006, 182–183, 186–187; Strahl 2018, 267–273, 439–449.

6 O’Keefe 2006, 236–241.

7 For the text of the Second Protocol, see the website of UNESCO, <https://www.unesco.org/en/heritage-armed-conflicts/convention-and-protocols/second-protocol> (last accessed 23 July 2024).

erlands only a few years after the Blue Shield came into being.⁸ The experts who belonged to these national committees pursued the goal of strengthening the implementation of the 1954 Hague Convention in their own countries, thus contributing to the global effectiveness of the Convention. They had recognised that this required targeted specialist advice as well as lobbying in the High Contracting Parties themselves. At the time of writing (March 2023) there are 31 national committees worldwide.⁹

The foundation of the German National Committee was achieved with some delay despite the commitment of many actors. Ultimately, it required an impulse from the outside which – as is unfortunately so often the case in the protection of cultural property – came about through the destruction of cultural property. The targeted attacks and destruction of heritage sites by the Islamic State in Syria and Iraq, which were followed with horror in Germany, gave the founding initiative the impetus it needed. On 9 February 2017, the key professional organisations and authorities met first for a round table and then, on 16 June 2017, for the founding meeting of the German National Committee of Blue Shield

The basic structure that has characterised the Blue Shield at the international level is mirrored in the German National Committee. The identity of a network, an association of individuals and organisations who want to work for the protection of cultural property during crises, determines our association's structure. This is particularly evident in the composition of the board. It consists of 12 individuals and institutions, with the presence of the six constituent members being essential. These include – in accordance with the formal requirements of a Blue Shield national committee – the German equivalents of the so-called 'Founding Four' as representatives of the individual cultural heritage sectors: ICOM Germany, ICOMOS Germany, the German Library Association (dbv) and the Association of German Archivists (VdA).¹⁰ In addition, the German UNESCO Commission and the German Society for the Protection of Cultural Property (DGKS) are represented on the Board.

The mission of the Blue Shield, the national committees as well as Blue Shield International is defined in the statutes of Blue Shield International: 'Blue Shield is committed to the protection of the world's cultural property, and is concerned with

⁸ Bogoeski 2017, 20.

⁹ For the current status of national committees, see the website of Blue Shield International, <<https://theblueshield.org/what-we-do/national-committees-around-the-globe/>> (last accessed 15 March 2023).

¹⁰ See the website of Blue Shield Germany. <<https://www.blue-shield.de/vorstand/>> (last accessed 12 November 2023).

the protection of cultural and natural heritage, tangible and intangible, in the event of armed conflict, natural- or human-made disaster'.¹¹

The 1954 Hague Convention and its two protocols continue to form the primary context for the Blue Shield's activities. The 1954 Hague Convention is complemented by other instruments of international law such as the Additional Protocols to the Geneva Conventions (1977) or the Rome Statutes, by strategic policies and programmes of the UN and UNESCO as well as by international initiatives for disaster management such as the Sendai Framework for Disaster Risk Reduction.

In order to work on these topics and their underlying issues the Blue Shield defined six areas of activity for itself. These are:

- Legal compliance, policy and their implementation
- Capacity building activities, education and training in support of the Blue Shield's areas of activity
- Co-ordination – of Blue Shield members and with partner organisations
- Proactive protection and risk preparedness
- Stabilisation, post-disaster recovery and long-term/ongoing support activities
- Emergency response

These areas structure the activities of both Blue Shield International and the national committees. They support the development of the strategic plans guiding the work and the annual action plans.

2 The Blue Shield Approach

Delivering effective cultural property protection in times of crisis is a complex and difficult task. It requires coordinated action of many actors that usually operate in dissimilar ways and with different priorities – and all of that in a situation that does not allow for lengthy negotiations. Recognising this reality, the Blue Shield defined the key aspects needed so that the organisation could realise its mission and contribute to the protection of cultural heritage. This approach is simply called the Blue Shield Approach and is visualised in Figure 1.¹²

¹¹ See the website of Blue Shield International, <<https://theblueshield.org/what-is-blue-shields-mission/>> (last accessed 13 March 2023).

¹² The current version can be found on the website of Blue Shield International, see <<https://theblueshield.org/about-us/approach-ethics-and-principles/>> (last accessed 13 March 2023).

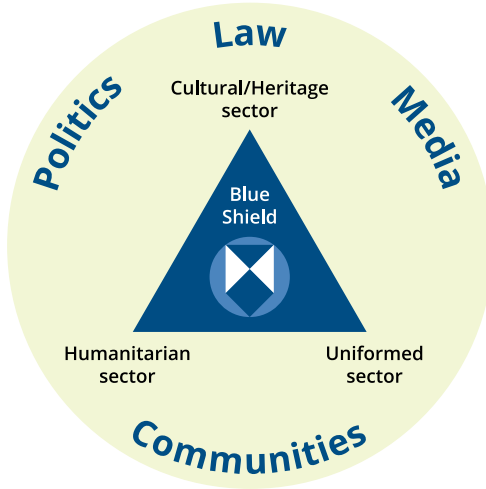


Fig. 1: Visualisation of the Blue Shield Approach. Image: Blue Shield International, 2022

At its core, the Blue Shield Approach recognises that there are three sectors which can contribute significantly to cultural property protection: the heritage sector, the uniformed sector and the humanitarian sector. The Approach aims to ensure that these three sectors develop a common basic understanding regarding a few core points. This includes the cultural heritage sector's argument that the unnecessary destruction of cultural property – whether self-induced or permitted – can undermine the success of military missions, security operations or post-conflict or post-disaster humanitarian assistance, whereas successful outcomes can be achieved by integrating the protection of cultural property first into planning and then into practice. At the same time, advocates of cultural heritage protection – particularly when we focus on objects – must put the security and social, spiritual and economic well-being of people at the forefront of their actions. That being said, as heritage professionals we operate under the premise that people's social, spiritual and economic well-being is to a large extent linked to their cultural heritage. However, it simply does not rank higher than their lives and safety, to put it plainly. So in principle, all three sectors are already working towards the same overarching goal, which is the survival of people and the maintenance or rebuilding of healthy, peaceful, stable and sustainable communities.

The Blue Shield, at both the international and national level, pursues the establishment, development and maintenance of relationships between these sectors in relation to cultural heritage protection. All three sectors work within a context that is usually defined and limited by laws, politics and the media. Equally important, if not more so, is that the context in which they operate is inhabited by diverse international, national, local and at times even indigenous communities.

As has been argued by Peter Stone, the current president of Blue Shield International, several aspects determine whether this approach is successful.¹³ For one, dialogue among the sectors can only be productive if it is conducted in the spirit of mutually beneficial diplomacy and action. This requires that all three sectors enter into such dialogue with the understanding that they may change their views and practices around the issue of cultural heritage protection. For that to happen, the participants in this dialogue have to accept the differing priorities of each sector and present the requirements of their respective priority in line with the existing agendas of the others. The latter is particularly relevant for the cultural heritage sector. The most crucial aspect, however, is this: to be effective in times of crisis, partnership among the sectors must be developed before a crisis. This is the case for intersectoral action during armed conflict and disaster but also as part of post-conflict and post-disaster stabilisation. This imperative is reflected in the so-called ‘4-Tier Approach’ developed by Peter Stone for the cooperation with the military.¹⁴

3 The Blue Shield’s Activities in the Field of Emergency Response

Emergency response is one of six areas of activity for the Blue Shield, as defined in the Blue Shield Approach. In line with the organisation’s mission it does provide – where possible – emergency support both in the context of armed conflict as well as disasters. Since this paper focuses on the latter it will review how the Blue Shield responded to several crises which – among other things – affected cultural property.

3.1 Support through Volunteers

One of the earliest international missions of the Blue Shield took place in Germany in 2009, in response to the collapse of the Historical City Archive of Cologne on 3 March of that year. This incident had a tremendous effect not only on the people and the institution it directly impacted but also on the field of cultural property protection in Germany. In fact, it significantly contributed to the establishment of the Coordination Office for the Preservation of the Written Cultural Heritage (KEK).

¹³ Stone 2022.

¹⁴ Stone 2013, 166–177.



Fig. 2: Blue Shield delegation and Ulrich Fischer of the Historic City Archive at the site of collapse in Cologne. Photo: National Archives of the Netherlands, 2009

Beneath the Historical Archive construction work had been taking place to build the tunnel for a new subway line. Defects in one of the concrete walls of the tunnel eventually resulted in a collapse of the tunnel itself. With groundwater, gravel and earth rushing into the tunnel, a funnel was formed directly under Archive's building, tearing it down. While the Historical Archive could be evacuated in time, two residents in a neighbouring building died when this building collapsed as well. The primary objective of the emergency forces was the rescue or rather, as became clear later, the recovery of the two missing persons. Salvaging the extensive collection encompassing 30 kilometres of archive shelving was, therefore, the secondary objective. The retrieval of the archive collection began with months-long salvage operations. They were conducted by firefighters and search and rescue personnel but also numerous heritage professionals, many of which volunteered to support the operations.¹⁵ The salvage of archival material above-ground lasted until September 2009. Almost 85% of the collection was saved, albeit in a severely damaged state.

¹⁵ For an overview of the recovery efforts, see Stadt Köln 2017.

The months-long salvage operation required large numbers of volunteers, most of which were from Germany, however, there were also offers of help from abroad including from the Blue Shield. More than 140 heritage professionals, most of them from the archive section and hailing from the Netherlands, France, Sweden, Switzerland and other European countries, followed the call from the national committees in the Netherlands and France.¹⁶ In two separate missions (April/May and August 2009), the volunteers supported the operation by administering ‘first aid’ to the salvaged collection objects, by sorting material (rubble vs. collection), separating dry and wet materials, cleaning, registering and drying partly wet material and preparing other material for freeze-drying on secondary locations.¹⁷

This example illustrates one option for the Blue Shield to support an emergency response: organising and at times training volunteers who are active heritage professionals. When needed, such volunteers may be deployed both within the country of the respective national committee or abroad, as was the case in Cologne. Responding to a clear request for aid, the Blue Shield can activate an extensive network of professionals either via the ‘Founding Four’ (ICOM, ICOMOS, IFLA and ICA) or the national committees. The capabilities of this network could be seen again following the extreme flooding events in Belgium in July 2021. Blue Shield Belgium could offer the support of qualified heritage professionals to institutions impacted by the floods, e. g., the flooded Centre de conservation et d’étude de biens archéologiques wallons in Namur where archaeological objects were stored, museums in the city of Verviers and the church of Saint-Gilles in Fraipont.¹⁸

If conducted properly, such volunteering missions provide crucial help for the heritage institutions affected by major disasters and can offer expert advice while on the way to recovery. They also entail a number of organisational issues, however, that need to be addressed. Aside from transport, boarding and lodging there is the question of insurance, concerning any damage caused by a volunteer and – more importantly – any injury a volunteer might sustain during the course of the mission. After all, emergency situations are potentially hazardous and pose various challenges for health and safety, be they physical or mental. Even if the organisation sending volunteers might not be legally liable in either of these scenarios it should at least feel committed to ensuring the safe return of the people sent

¹⁶ The missions were organised in the framework of the then still existing Association of National Committees of the Blue Shield (ANCBS) which had formed in 2008. The ANCBS and the International Committee of the Blue Shield merged in 2016 to form Blue Shield International.

¹⁷ The mission reports are available on the website of Blue Shield International, see <<https://theblueshield.org/download/blue-shield-mission-reports/>> (last accessed 11 March 2023).

¹⁸ For more information, see the report of Blue Shield Belgium, which is available online: <<https://theblueshield.org/disaster-response-throughout-the-summer/>> (last accessed 11 March 2023).



Fig. 3: Volunteers of Blue Shield Belgium at the church of Saint-Gilles in Fraipont, July 2021. Photo: Blue Shield Belgium, 2021

on the mission and identify suitable options in order to provide care in the event of any injury. During the missions to Cologne and Belgium, the mission reports state that insurance (although the exact extent is unclear) was provided by the receiving institutions.¹⁹ A second key issue is personnel and quality management because the specific ability and performance of the volunteers on-site reflect back on the organisation that sent them. Blue Shield volunteers are expected to be heritage professionals providing a particular specialisation that is needed at the receiving institution.

¹⁹ I thank Christina Ceulemans, Secretary-General of Blue Shield Belgium, for providing additional information regarding the insurance of volunteers during missions.

If the expertise of a volunteer is found lacking or he/she is perhaps behaving in a problematic manner, this would have a negative impact on the reputation of the sending organisation – in our context of the Blue Shield. For a non-governmental organisation, public reputation and trust in its (members') expertise are existential; once damaged or lost, they are not easily recovered. Therefore, the professional capacity, expertise and good conduct of the volunteers sent on missions should be sufficiently verified in advance.

3.2 Damage and Post-Disaster Needs Assessments

For any organisation like the Blue Shield that aims to protect cultural heritage during crises it is crucial to know which cultural assets are threatened, what damages have occurred and which specific hazards might still pose a risk to them. The instruments to generate such intelligence are damage assessments and post-disaster needs assessments. Both tasks require sufficient access to verified information or to the cultural heritage assets themselves if the final set of data is to be of sufficient value for whomever is using it to plan first aid efforts. For this reason, qualified staff should conduct such assessments on-site so that they can review all components of the cultural heritage, both tangible and intangible. For this very reason, they require the consent and cooperation of the person, community or institution responsible for it.²⁰ In the context of (international) missions, the Blue Shield might be able to offer the support of experts – qualified members or otherwise associated individuals – if such capacity is missing in the country or region where the damage occurred.

The first Blue Shield missions providing damage assessments were carried out in response to the disastrous earthquake in Haiti on 12 January 2010 which claimed more than 220,000 lives.²¹ A small team led by Danielle Mincio from IFLA and Christophe Jacobe, the then president of Blue Shield France, travelled to Haiti in April 2010 to conduct damage and post-disaster needs assessments. During the mission, they visited archives and libraries in particular, such as the National Library of Haiti, several smaller public libraries and what then remained of the archives of the Ministry of Foreign Affairs whose building had completely collapsed.²² In their report they documented the damage in a brief summary, listed the work already

²⁰ See, for example, the description in ICCROM 2016, 42–66, especially 46.

²¹ United Nations 2011, 16.

²² The report of the first mission is accessible via the website of Blue Shield International, see <<https://theblueshield.org/icbs-mission-to-haiti-april-2010/>> (last accessed 15 March 2023).

done by Haitian staff and other professionals and proposed follow-up measures required in the short and long-term. A second mission followed in June 2010.

Based on the mission findings, the mission scope quickly expanded from conducting assessments to developing a project designed to respond to the needs identified. The first report already mentioned that a mobile treatment centre was planned to be established where damaged archival material and books might be restored or at least might benefit from basic first aid measures. Due to the climate in Haiti, tents and containers were ruled out for such a centre. Instead, the concept opted for a wooden structure, the parts of which could be preassembled and shipped from Europe (Switzerland and France, to be exact) to Haiti. For the development of the facility, the concept and fundraising, a separate entity was founded, the association *L'Arche du Bouclier Bleu*.²³ Unfortunately, the building was never realised. According to Sanne Letschert of the Prince Claus Fund in the Netherlands, which was supposed to serve as one of the funding bodies, the project was stopped in January 2014 after it had been delayed due to problems with the designated plot of land, the lack of cooperation with relevant government departments and the building materials being stuck at customs.²⁴ In the end the complex situation in Haiti, both the dysfunctional state of official institutions²⁵ as well as the added pressure resulting from the disaster created a barrier too high for the project team to overcome.

Two other more recent assessment missions should be noted here: Blue Shield Turkey conducted a damage assessment in the region of Manavgat (Antalya) after the extensive wildfires in August 2021, documenting the loss of rural architectural heritage buildings and damages to archaeological remains.²⁶ In 2020, Blue Shield Cameroon carried out a mission to assess the state of conservation of seven cultural sites and museums.²⁷ The assessment revealed that built structures at several heritage sites listed on the country's Tentative List for the UNESCO World Heritage Convention,²⁸ such as the Bafut Palace, the Tower of Goto Goufey and the Babungo Museum, all had sustained damage. Stone sanctuaries had been demolished, mon-

²³ At the time of the presentation in November 2021, information was still available on the website of the association (former link: <<http://www.arche-bouclierbleu.org/>>). It has since then been deleted. The treatment centre, the so-called 'Arche', is briefly mentioned in Deschaux 2018.

²⁴ Information provided via e-mail on 26 November 2021.

²⁵ See the introductory remarks of Edmond Mulet, Special Representative of the Secretary-General in Haiti, in United Nations 2011, 4.

²⁶ The report is available on the website of Blue Shield International, see <<https://theblueshield.org/disaster-response-throughout-the-summer/>> (last accessed 15 March 2023).

²⁷ Nana 2021, 17–18.

²⁸ See the website of UNESCO: <<https://whc.unesco.org/en/tentativelists/?action=listtentative&state=cm&order=states>> (last accessed 12 November 2023).

uments been hit by bullets, some museum collections were destroyed and many communities had been displaced, which not only destroyed tangible cultural artefacts but also disrupted practices and expressions of intangible cultural heritage.

3.3 First Aid Efforts

Since the early missions in Cologne and Haiti there have been other efforts to provide first aid to cultural property following disasters, but little information is available about them.²⁹ To my knowledge, no other project comparable in complexity to the mobile treatment centre had been attempted until 4 August 2020, when a massive blast occurred in the Beirut port area. The incident had its origin in welding works in a storage building, which set off fireworks stored therein. This, in turn caused 2,750 tons of Ammonium Nitrate that had been improperly stored in the harbour since 2013 to explode.³⁰ As a result, at least 218 people were killed and c. 7,000 were injured.³¹ The blast mostly affected the districts of Medawar, Rmeil, Port, Saifi, Bachoura, Zoukak el-Blat and Minet el-Hosn where many of Beirut's heritage buildings and institutions are located.

In the aftermath of the incident, the Blue Shield together with key partners implemented the most extensive, complex and – in the view of the organisation – successful protection efforts in its history.³² The operations were carried out in close cooperation with the 'Founding Four' and coordinated on the ground by Blue Shield Lebanon and its local partners. Several international funding bodies such as the Prince Claus Fund, Aliph and the Gerda Henkel Foundation provided the necessary funds. In a joint approach, the different partners utilised their networks and expertise and collected information on the types of tangible cultural heritage represented within the Blue Shield: libraries, archives, museums and built heritage. They shared information about damaged cultural heritage on an online platform, making it available to governmental institutions, cooperating organisations and the funding bodies. The assessment surveys were conducted by heritage professionals and volunteers, many of them students from the field of architecture, engineering and conservation, using standardised forms.

Based on the results of the damage assessments, the Blue Shield – enabled by the funding bodies – provided resources to deliver first aid to affected cultural

²⁹ Bogoeski 2017, 21–22.

³⁰ Action on Armed Violence 2021, 6.

³¹ Action on Armed Violence 2021, 8.

³² Blue Shield Lebanon 2021.

property. In the delivery, the organisation cooperated with the United Nations Interim Force in Lebanon (UNIFIL), the Lebanese Armed Forces and the Ministry for Culture. One of the heritage buildings which sustained severe damage and became part of the mission was the Ministry of Foreign Affairs. As part of the first aid measures, the remaining roof tiles were cleared away and the roof closed again using a temporary emergency cover. Inside the building debris had to be cleared away, the roof structure had to be supported through scaffolding and architectural fragments were salvaged and stored for restoration at a later date. The stabilisation work was carried out by trained craftsmen procured by the Lebanese Armed Forces. The entire project spanned five weeks.

After the blast the post-disaster needs of Beirut were immense even when reviewed through the focused lens of cultural property protection. According to the Ministry of Culture, about 640 historical houses were damaged and almost 60 of them were close to structural collapse due to the blast.³³ Such a disastrous situation, which was again embedded in a much larger, life-threatening scenario, required more than one network of partners to achieve recovery and rehabilitation of cultural heritage. Therefore, the Blue Shield was one contributor and part of a thankfully wide array of institutions and organisations supporting the emergency response, stabilisation and ongoing restoration.

For the Blue Shield, the emergency operations in Beirut confirmed key aspects formulated in the Blue Shield Approach. This includes the significance of previously established contact and cooperation with the uniformed sector, in this case the Lebanese Armed Forces and UNIFIL. At the time of the blast, there had already been a very active initiative to form a national committee of the Blue Shield, known today as Blue Shield Lebanon, which truly hit the ground running when coordinating the emergency response together with its local partners. The interdisciplinary structure of the Blue Shield, uniting experts for the different types of tangible cultural heritage, could be brought to full fruition. The different organisations had access to their specialist networks for the damage assessments and then united their findings in a multi-disciplinary process. Finally, the coordinated approach among the partner organisations established sufficient information so that international funding bodies were able to back the emergency response with financial resources. In the mission in Beirut many of the necessary requirements for a successful emergency response were met, which cannot yet be expected in every country or region where the Blue Shield has a formal presence. However, the Beirut mission illustrated an almost ideal model for the way in which other national committees of the Blue

³³ Action on Armed Violence 2021, 11.



Fig. 4: Group photo of Blue Shield International and UNIFIL celebrating cooperation on 27 October 2020. Photo: Blue Shield International, 2020

Shield need to set themselves up so that they can make an effective contribution to cultural property protection if a disaster should occur in their country.

4 Outlook

The Blue Shield missions described above highlight a varied portfolio of actions through which both Blue Shield International and the national committees can contribute to the protection of cultural property in times of crisis. From large numbers of professionally trained volunteers to experts conducting damage and post-disaster needs assessments, to complex, coordinated operations as part of wider disaster response, the Blue Shield has demonstrated how it can support first aid efforts for cultural property. It is not a certainty, however, that such missions are successful or even possible in every crisis, as was illustrated by the eventually cancelled project after the earthquake in Haiti in 2010.

One of the undisputed key conditions that can indicate the chances of success for a mission is the formal presence of the Blue Shield in a country. The level of this presence can vary significantly, from a well-established, fully accredited national

committee to an advanced initiative close to forming a national committee or perhaps ‘only’ a national correspondent of the Blue Shield. Depending on the type of presence the quality of the network with national or local governmental institutions or other NGOs and the capacity to act in response to an emergency would be either stronger or weaker. The stronger the capabilities of the organisation or network, the better it can respond and, if need be, integrate aid from other regions or even countries.

Expanding the Blue Shield network by forming well-established national committees has, therefore, been a key objective to the organisation. The organisation has experienced a slow but steady growth in the number of national committees which has strengthened the movement considerably. Ideally, these national committees can learn from the experiences – what worked and what did not work – of the Blue Shield in the field of emergency response so they can form their organisational structure and build institutional capacity, allowing them to serve as hubs for information and coordination if a disaster should occur in their country – as was demonstrated in Beirut in 2020.

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Johanna Leissner

The Climate Crisis and Its Impact on Our Cultural Heritage – ‘Strengthening Cultural Heritage Resilience for Climate Change’: A Survey in Europe by the EU OMC Expert Group

Abstract: The Earth’s climate is becoming hotter and more extreme. Scientists are no longer talking about climate change but about climate crisis and it is high time to act. The next World Climate Conference COP28 will take place in Dubai and important climate policy decisions are pending: defining specific solutions that must be scaled up this decade to limit warming to 1.5 degrees; building resilience and mobilising finance at scale; looking where the world stands on climate action and support; identifying the gaps; and working together to agree solution pathways to 2030 and beyond. These issues also affect our cultural heritage – we know it is threatened by the climate crisis and that irreplaceable losses are already occurring. What can we do to protect cultural assets? What dangers exist for the written cultural heritage in libraries and archives? How do we deal with losses? We urgently need to address these issues. That is why the Council of the European Union has mandated the EU Commission to set up an expert group of Member States based on the Open Method of Coordination (OMC). Bearing in mind the Paris Agreement (2015) and the UN Sustainable Development Goal 13 on climate change, the state of play of cultural assets in relation to climate change in the respective countries has been identified and good practices as well as innovative measures for historical environments have been collected. Delegates from 25 EU Member States and three associated countries started working in January 2021 and they published their results and recommendations in September 2022. The survey undertaken by the delegates of the OMC expert group shows that little information from the area of libraries and archives is available, which demonstrates an urgent need to deal more intensively with the effects of climate change and to develop appropriate measures.

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1 Climate Change Becomes Climate Crisis – Background

Exactly 20 years ago, in 2003, the EU Commission was the first research funding institution in the world to publish a call for scientific research into the effects of climate change on cultural heritage. At the time this seemed to be a purely academic research question far removed from reality. Since then, climate change has progressed faster than climate models had predicted and, meanwhile, its impact on cultural heritage can no longer be overlooked.

The continent of Europe is particularly affected by the rise in temperature, as shown in the report published on 23 April 2023 by the Copernicus Climate Change Service (ESOTC) which describes the most important climate events of 2022 in Europe and around the world. These data-based findings show continuously rising temperatures and an increasing number of extreme events in 2022 and in a long-term context. Here is an extract from a brief summary of the report:

In recent decades, Europe has warmed faster than any other continent, with temperatures rising twice as fast as the global average. In summer, much of the continent experienced exceptional heatwaves, and maximum temperatures in Europe reached around 10°C higher than typical maximum temperatures in summer. Large parts of Europe suffered extreme and prolonged heatwaves, and southern Europe experienced the highest number of days with very high heat stress levels since records began. Low amounts of rainfall and high temperatures led to widespread drought. Carbon emissions from summer forest fires were the highest in 15 years, and in some countries, the highest emissions in 20 years were recorded. A record loss of glacier ice was recorded in the European Alps.

Climate change has arrived in Europe and has long since become a climate crisis. Climate change is affecting everything and each one of us, including our cultural heritage, causing enormous damage and loss at an unprecedented speed and on an unprecedented scale. At the same time, the traditional knowledge stored in our cultural heritage offers inspiration for green, sustainable solutions to the climate crisis.

2 Cultural Heritage in European Policies: The Political Mandate for the OMC Expert Group of EU Member States ‘Strengthening Cultural Heritage Resilience for Climate Change’

Cultural heritage plays a key role in making our societies fit for the future. This applies more especially to the written cultural heritage in which the achievements of our civilisation are documented and made available to future generations. The loss of written records would render our knowledge-based society disoriented as they form the basis for innovation and offer suggestions for how we might meet the challenges of climate change. In addition, the written records in libraries, archives and museums are authentic sources, which cannot be valued highly enough in the age of fake news and ChatGPT. The EU and its Member States have recognised the importance of cultural heritage and therefore committed themselves as early as 2009 to the protection of cultural heritage in Article 3 of the Treaty of Lisbon while, in 2019, the EU adopted the European Green Deal with the aim of becoming the first climate-neutral continent by 2050 and meeting the major challenges of climate change. By doing so the EU is taking on a leading role at global level. Inspired by and building on the Green Deal and the Council of the European Union’s Work Plan for Culture 2019–2022, the establishment of an Open Method of Coordination (OMC) expert group of EU Member States was envisaged for the first time; it will address climate change and cultural heritage in order to assess the current situation in the Member States, the available knowledge as well as the deficits and obstacles that need to be removed. This is the only way to strengthen resilience to climate change. With the establishment of the OMC expert group, the EU and Member States emphasise the urgent need for an in-depth debate on climate change and cultural heritage to ensure that the discussion and planning of measures to tackle climate change are initiated both at EU and national level.

To date, neither the EU Member States nor the EU have adequate laws, policies, strategies and action plans to mitigate the consequences of climate change for cultural heritage.

In response, in October 2020, the EU Commission implemented the mandate of the Cultural Affairs Committee of the Council of the European Union to set up an EU OMC expert group. Twenty-five EU Member States and three associated countries agreed to participate in the expert group, which began its work in January 2021.

The participating countries are Austria, Belgium, Croatia, Cyprus, the Czech Republic, Estonia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, Romania, Slova-

nia, Slovenia, Sweden, Spain, as well as Norway, Iceland and Switzerland as associated countries. Owing to its federal structure, Germany has sent two delegates: representing the federal states is Christina Krafczyk, President of the Lower Saxony State Office for the Preservation of Monuments, while the federal government is represented by the present author, Scientific Representative of the Fraunhofer-Gesellschaft and the Alliance for Research on Cultural Heritage, who was elected Chairperson by the delegates at the first meeting.

2.1 Objectives and Scope of the Mandate

The objectives and scope of work of the OMC expert group are set out in the mandate of the Council of the European Union of 12 October 2020; the OMC expert group shall investigate current and emerging threats and impacts of climate change on cultural heritage, including cultural landscapes. It shall explore appropriate adaptation and mitigation measures, identify potential risks and focus on building the resilience of cultural assets in the face of a changing environment while avoiding maladaptation. The group is also tasked with examining the contribution that cultural heritage with its inherent traditional knowledge, such as traditional craft techniques, resource-saving and climate-adapted construction methods or low-energy ventilation systems, can make to mitigate and combat climate change in line with the objectives of the Green Deal.

2.2 Current Situation and Results from the Member States

To begin with, the expert group decided that both tangible and intangible cultural heritage should be considered. The situation in the countries was ascertained by means of a multi-page questionnaire: in about half of the countries, policies such as the National Adaptation Plan for Climate Change or the National Recovery Plan (e. g. in Scandinavia, Italy, Greece and Cyprus) already exist that take both cultural heritage and climate change into account. However, nine countries still lack such policies, with Germany being one of them. One problem mentioned by most delegates was the different responsibilities of the ministries which often barely communicate or co-operate with one another; this leads to a significant weakening of the cultural heritage sector both at EU and national level.

But what threats does climate change pose to cultural heritage? That was one of the main questions put to the delegates of the EU expert group. Unsurprisingly, the effects of extreme climatic events were named as the main hazard, for example heavy precipitation, heat waves or prolonged periods of drought, the effects of

which have been increasingly observed in recent years, particularly due to the devastating floods in the Ahr valley but also in historic gardens and cultural landscapes. For many EU Member States rising sea levels in particular present an ever-increasing threat as many cultural heritage sites are located along coastlines, while indirect threats such as socio-economic effects or demographic change are identified as further dangers. In addition to extreme events, gradual, slow climate change is also damaging cultural heritage, which involves the acceleration of corrosion processes on many historical materials such as glass, metal and stone or iron gall ink due to higher temperatures and the general change in climate as a whole – rainfall, direct sunlight, wind speed and direction, differences between day and night, frost and thaw cycles, absolute humidity, to name just a few climatic parameters.

Another question dealt with the type of cultural heritage that is being adversely affected by progressive climate change. Here the delegates listed buildings and monuments firstly and cultural landscapes secondly, where the effects can sometimes even be seen with the naked eye. The effects of climate change on movable cultural assets such as works of art or printed books and manuscripts in museums, archives and libraries were mentioned less often, as very little research has been carried out in this area to date.

2.3 Collecting Examples of ‘Good Practice’

An important task of the mandate is the collection of examples of *good practice*. These examples are intended to show innovative and sustainable solutions based on methods and measures that are already in use today to contribute to a CO₂ reduction on the one hand and to promote adaptation to climate change on the other. This is because the most important project of the European Commission, the Green Deal and the initiative of the current Commission President Ursula von der Leyen, the New European Bauhaus, includes the areas of construction as well as the existing building stock at European level. A key point of discussion within the work of the OMC expert group was the examination of the CO₂ life cycle of historically significant and listed buildings; to this end, it is necessary to assess the existing building stock and its preservation within the framework of a holistic approach. The aim of all regulations should take into account that the preservation of existing buildings that have the potential to be renovated and improved – and here in particular historical monuments – is already an advantage in terms of climate policy, which is illustrated by the example of grey energy. In Europe, too, buildings consume by far the most energy and contribute to around one third of CO₂ emissions. Even with new, energy-saving buildings half of the impact on the environment is already reached before they are even operational.

For this reason, greater focus needs to be put on grey energy in existing buildings, especially in listed buildings. For a comprehensive assessment the future climatic situation, i. e. climate change, must also be taken into account in the operation of buildings (heating, cooling, humidification and dehumidification, shading) and in their maintenance. Listed buildings occupy a leading position in terms of ecological and climate-friendly construction; a very high percentage of these buildings have used a wide range of climate-friendly building materials, both in their initial construction and in their ongoing restoration. Most often, locally-produced materials were used that did not require long-distance transport, as is otherwise often the case today. Due to these two factors, architectural monuments have a positive ecological balance, for example through the use of wood from local forests with its high CO₂ capture capacity.

However, the OMC expert group has found that there is a lack of fundamental quantitative as well as further qualitative data on precisely this key topic, which prevents entry into a results-orientated political discussion on energy efficiency in existing buildings. Together with the importance of architectural monuments and historically important buildings in urban and rural areas as core elements of European identity, the preservation and respect for their special characteristics remains of the utmost importance in the context of the Green Deal.

2.4 Research – The Indispensable Driver to Strengthen Cultural Heritage Against Climate Change

Research and innovation are fundamental prerequisites for developing strategies and measures to protect cultural heritage from climate change, which is demonstrated by the 83 examples of ‘good practice’ that the EU OMC expert group has collected as part of its mandate. Most of the examples come from EU research, as the EU Commission has increasingly funded research projects in this area in recent years and continues to do so. Nevertheless, there are still major gaps in our knowledge regarding how, and to what extent, climate change is affecting our movable heritage, which is primarily displayed and stored indoors. Research efforts at national level are particularly lacking here, especially in Germany, where there has been no national research programme since 1997. It must be examined, for example, what cooling and energy requirements archives and libraries will have in view of the increasingly frequent and faster occurrence of heatwaves, what threats the arrival of new types of insects will pose and what skills employees at cultural heritage institutions will need in order to develop sustainable solutions to the complex issues involved.

In addition to these specialist aspects, it is also important to regain the international competitiveness of German conservation and cultural heritage research and

secure the next generation of researchers. The setting up of a new national, multi-disciplinary research programme for the preservation of cultural heritage in times of climate change will strengthen urgently-needed co-operation and concentrate the excellence available in the institutions.

The lack, or scarcity, of German research was also evident in the difficulty of finding examples of ‘good practice’. Germany was only able to contribute three examples to the OMC expert group: climate-neutral Dyck Castle and Park, the energy-optimised Margarethenhöhe district in Essen and the EU Climate for Culture project. These and other examples of ‘good practice’ are described in more detail in the appendix to the EU OMC report (Figure 1).³⁴

Furthermore, research is urgently needed to gauge the economic and financial impact. We still do not know what costs will be incurred by our society and what budgets will have to be made available to make our cultural heritage climate-resilient. In its report the OMC expert group emphasises the unique role that research has played and will continue to play in promoting cultural heritage in the context of discussions, actions and research development on climate change.

3 The Results of the EU OMC Expert Group May Be Summarised as Follows:

- Extreme climate events and gradual climate change are having an unprecedented impact on all types of tangible and intangible cultural heritage around the world.
- Large gaps still exist in the understanding and knowledge of the effects of climate change, particularly with regard to intangible as well as movable cultural heritage.
- There is a lack of relevant and reliable data, particularly with regard to the life cycle of buildings and the costs of structural adaptation and climate technology retrofitting.
- Cultural heritage institutions need incentives and financial support (e. g. tax relief, special write-offs) to adapt to climate change.

³⁴ EU OMC report 2022; EU OMC report, good practice 2022. The report of the OMC expert group in German, English and French (<<https://doi.org/10.2766/44688>>) and the collection of 83 examples of ‘good practice’ (<<https://doi.org/10.2766/31292>>) can be downloaded free of charge from the website of the Publications Office of the European Union.

- It is difficult to collect climate-relevant information on cultural heritage in Europe; there is no overarching centralised data and knowledge platform.
- There is a lack of awareness of the urgency of adaptation at all levels.
- Adaptation and resilience plans must be developed immediately.
- Europe needs a forum for mutual exchange. There is a need for a joint monitoring agency.
- There is an urgent need to invest in skills through training and further education opportunities, especially in the (traditional) crafts sector.
- Co-operation and exchange between cultural heritage experts, climate scientists and decision-makers must be intensified.
- Cultural heritage is not integrated in important mainstream policies at EU and national levels, e. g. cultural heritage is missing from many national adaptation plans.



Fig. 1: Cover page of the report of the EU OMC expert group ‘Strengthening cultural heritage resilience for climate change’.
Image: European Union, 2022

4 Conclusion and Outlook

Climate change is endangering our European cultural heritage. The 83 examples of ‘good practice’ already show some solutions for how cultural heritage can be adapted to climate change and contribute to reducing greenhouse gases but, never-

theless, we are only at the beginning of developing suitable adaptation measures. Increased co-operation at all levels is required, as well as intensive engagement with the issue. EU research programmes are already providing good contributions to this, but the Member States in particular are called upon to set up and promote more interdisciplinary and multidisciplinary research projects. The cost of preserving the memory of our civilisation for future generations is presently still unknown, and additional economic studies are therefore needed at both EU and national level to look at adaptation measures. However, our cultural heritage is not only a victim but also part of the solution. It is a rich resource for how our ancestors dealt with climate change and the sustainable solutions they developed, which we should remind ourselves of today. By overcoming these challenges, Europe will take on a leading role in the sustainable preservation of cultural memory.

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Jody Butterworth and Sam van Schaik

Reflections on Two Decades of the Endangered Archives Programme

Abstract: The Endangered Archives Programme (EAP) enables the digitisation of archives around the world that are in danger of loss or deterioration. Established at the British Library in 2004, the Programme celebrates its twentieth anniversary in 2024. In this paper we look back on two decades of EAP starting with the initial agreement with the charitable foundation Arcadia, which funds EAP's work. The first part of the paper revisits several other key aspects of the early phase of EAP including the initial choice of microfilm for archive preservation which was soon replaced with the digital imaging practice that is still in place. Other early sources touched on here are the observations of the EAP Advisory Panel on the kinds of application EAP received and where they were from. The important role played by the British Library is discussed in terms of expertise provided in curation, conservation and digital preservation. The second part of the paper looks at EAP since 2018 when funding was renewed by Arcadia and a new agreement with the British Library was drawn up. This included new kinds of grants: the larger Area grants and the Rapid Response grant. This new era also saw the emergence of the Modern Endangered Archives Program funded by Arcadia and run from the University of California, Los Angeles (UCLA), which now works closely alongside EAP. Taking us to the present day, the paper turns to the sudden emergence of Covid-19 and how EAP responded to this emergency that affected projects and applicants across the world. Finally, we look to the future and how the breadth and depth of the digital archive produced by EAP projects has opened up new avenues for research.

1 Introduction

As more and more of the world embraces the industrial/technological revolution and as globalisation accelerates, the available evidence of pre-industrial societies, their history and culture, is fast disappearing – in Asia, Latin America, Africa and even parts of Europe.¹

¹ The rationale for the Endangered Archives Programme as stated in the initial *Agreement between Arcadia and the British Library* 2004, 3.

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The Endangered Archives Programme (EAP) enables the digitisation of archives around the world that are in danger of loss or deterioration. In 2024 the Programme celebrates its twentieth anniversary. The Programme has been made possible due to generous support from Arcadia, a charitable foundation that works to protect nature, preserve cultural heritage and promote open access to knowledge. Since 2002 Arcadia has awarded more than one billion dollars to organisations around the world. EAP plays a part in the greater vision of Arcadia to preserve global cultural heritage in its many forms; the Programme is administered by a small team based at the British Library who oversee the grant cycle and make the project outputs available online.

After such a long time all the people involved in the early years of EAP at the British Library – when the Programme was set up, when the criteria was agreed and the procedures tried and tested – have either retired or moved on to other positions.² In writing a short history of EAP for this publication it has been a fascinating task for us to read the early paperwork and pour over the Advisory Panel meeting minutes to uncover various deliberations, observations and decisions. What this process revealed is that several topics have been repeatedly discussed throughout the past two decades while other suggestions or ideas have been tried but discontinued. In this article we will look at these recurring themes and how they have been addressed. We will discuss this in two sections, initially looking at the first phase of EAP which ran from 2004 to 2018 and then at the shorter period of the second phase from 2018 to the present.

2 Phase One of the Endangered Archives Programme (2004–2018)

2.1 The Initial Agreement

It makes sense to start at the very beginning and look at the agreement drawn up between Arcadia³ and the British Library. The document provides a useful understanding of the reasoning behind the Programme and why the British Library was chosen as the administering institution. It provides a background for the funder's aims and gives a clear outline of the Programme, specifying the role of the Interna-

² The early EAP team comprised Graham Shaw (Director), Cathy Collins (Grants Administrator) who were involved from the beginning, Lynda Barraclough (Curator) joined in 2005.

³ Arcadia was originally known as 'The Lisbet Rausing Charitable Fund' but will be referred to by its current appellation for consistency.

tional Advisory Panel⁴ responsible for approving the grant awards. The agreement also defines the EAP team (a part-time director,⁵ a curator and grants administrator) with 15.2% of the initial ten million pounds going towards staffing and non-staffing costs within the Library (plus a small contingency) and the remaining amount going towards the grants and training (in the form of a bursary scheme). The agreement also outlines the British Library's commitments towards the Programme.

Not everything continues to be true today, but the document provides insights that are still relevant and could usefully be consulted regularly to see how the Programme might reflect on the original aims and practices set out by Arcadia and the Library.

There were two initial objectives for the Programme. The primary was to

bring into the international research domain neglected, vulnerable or inaccessible archival materials relating to 'pre-industrial' societies world-wide by securing their transfer to a proper local archival home and by copying for wider dissemination. This will achieve the underlying governing principle of making a significant difference to scholarship and research in a wide variety of subject fields.⁶

The secondary objective was:

[...] to assist in the future safeguarding of such archival materials in their countries of origin by creating new opportunities for the professional training of young archivists from developing countries.⁷

To achieve the second objective, the suggestion was to have four bursaries each year of six months' duration offered to overseas archivists and librarians. The aim was that they would receive professional training by staff at the British Library and would then be able to return to their countries and provide further knowledge exchange. The Library was to explore the possibility of linking to higher education institutions that offer library/archival training with the aim of advertising these bursaries to their overseas students. The failure of the bursaries was mainly due to the difficulties in obtaining short-stay visas. This objective is only now being addressed through the creation of regional hubs, a joint undertaking between EAP

4 The International Advisory Panel consists of seven to eight members from academic, library or archival backgrounds representing the regions where EAP funds projects. For information about the current membership of the Panel, see <<https://eap.bl.uk/whos-who>> (last accessed 22 April 2024).

5 The Head of the Asia and Africa section (APAC) was to spend 5% of their time working for EAP.

6 *Agreement between Arcadia and the British Library* 2004, 3.

7 *Agreement between Arcadia and the British Library* 2004, 3.

and the British Library's International Office, with collaborating institutions based in regions where EAP would like to see an increase of in-country applications.

Arcadia, having identified a critical need for preserving documentary heritage, developed the Programme into an annual grants competition to create facsimiles of endangered material. The surrogates would be kept locally and at the British Library – where its own worldwide collection meant it was a natural home for the copies. The physical material as well as the master copies would remain in the country of origin. These principals have not changed from the outset. Archival material from the inception of the Programme was to be defined in as wide a term as possible, including primary and secondary media used within the arts and humanities. Both printed and non-print material was to be considered for funding; listing rare books, periodicals and newspapers: national, regional or local government records, manuscripts and private papers, maps and charts, prints, drawings, photographs and sound records.

Five criteria were specified for evaluating each application: *Urgency* in safeguarding the material; *Vulnerability* and the condition of the collection and how much similar material had already been lost; the *Significance* of the archive and its relevance to a particular field of study, its uniqueness; *Feasibility* of the proposal; and the *Expertise and experience of the applicant(s)*, particularly their track-record of delivery. Although these criteria have been visible within the rather lengthy documentation for potential applicants, EAP has only recently made these core criteria more visible on its website, helping applicants understand what the Panel considers when assessing each application.

The initial agreement specified who could apply. It was expected that the majority would be academics from universities or similar institutions as this was deemed to guarantee the spending of the grant. It was agreed, however, that independent researchers could also apply to the Programme and the British Library would administer these grants. It was stipulated that any additional costs for providing this service could be negotiated between the Library and Arcadia. The maximum length of a project was to be a year but this was quickly seen to be unfeasible when the Programme started issuing grants as the maximum time limit increased to 24 months from its first round.

2.2 Surrogate Content and Its Availability to Researchers

Copying archival material has come a long way over the past 20 years. In the initial plans the British Library favoured microfilm as the preferred method of copying but applicants to EAP, presumably for ease while in the field, preferred digitisation. Once it became clear that EAP would be a digitisation programme the assumption was that relevant staff within the Library's imaging team would have the technical

expertise to assess the quality of the digitised images. For many years now, EAP staff have had this responsibility – ensuring the digitised outputs meet the standards of the British Library. The Panel was concerned that many project teams would not have the technical know-how to carry out digitisation of archival material and there was a suggestion of a two-day training course to be held at the Library each year. However, the practicalities of holding such a short course for project holders based around the world meant this did not happen – though it would have been a wonderfully collaborative training event and one we are only now addressing in the form of the regional hub workshops.

In the early years the camera of choice was often a compact camera, whereas now we are more prescriptive in the type of digital SLR to be used. Although the EAP team has some basic knowledge of the workings of a camera and the required image standards there is nothing quite like the expertise from having completed an EAP project. It was therefore decided to publish a how-to-do guide aimed at prospective EAP project holders and *Remote Capture: Digitising Documentary Heritage in Challenging Locations* was co-written by two project holders.⁸ Along with the publication EAP provides a digital appendix listing appropriate camera models, therefore bringing more conformity between one project and another, increasing the likelihood of image standards being equivalent to the Library's norms.

As the Library had initially preferred microfilm the initial plan was to make the surrogate copies available to researchers only within the Reading Rooms at the Library's London site. However, this changed after the Five Year Review commissioned by Arcadia and carried out by an independent reviewer, Sarah Tyacke, a former chief executive of the Public Record Office who led it at the time of expansion into the National Archives. Her recommendation was to make the digitised collections available on a dedicated website.

The uploading of content was, however, initially slow. The website was created in 2010 and by 2013 there were 26 projects online consisting of a modest 220,000 images. This then jumped to 80 projects the following year (1.5 million images) and 138 projects amassing 4.8 million images the year after. By 2017 EAP had 195 projects with 6.1 million images (and 25,000 sound recordings) available online. It was clear at this point the website was at capacity and a new solution was needed.

The huge increase in figures between 2013 and 2014 was a simple result of increased staffing from one EAP cataloguer to two. Of course making the outputs from the first five years of the Programme available on the website was not nec-

⁸ Andrew Pearson (project lead on EAP794 and EAP1013 and overseeing the training on several other projects) and Patrick Sutherland (project lead on EAP548, EAP749, EAP1016 and EAP1221); Butterworth et al. 2018.

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ENDANGERED ARCHIVES Supported by Arcadia

MAIN THREAT ABOUT GRANTS COLLECTIONS MAP SEARCH CONTACT

View collections from : Africa Americas Asia Europe Oceania

Terms of Use: To view EAP's full terms of use please visit our [Terms of Use page](#).

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Americas

Caribbean

EAP060 Diaspora collections at the major archives of the province of Matanzas, Cuba
 EAP295 Digitising the endangered archives of Grenada
 EAP345 A survey of the endangered archives of St Vincent, West Indies, during the slavery era
 EAP408 From the brink: identifying, collecting and digitising records of the Turks and Caicos Islands after the destruction of Hurricane Ike
 EAP596 Safeguarding Anguilla's heritage: a survey of the endangered records of Anguilla

Central America

EAP165 Rescue of two photographic collections of rapidly changing cultures in rural Guatemala dating from the 1890s through to the 1930s
 EAP593 Lekil Kuxlejal: archiving Tenejapa's indigenous heritage

South America

EAP207 'Faces drawn in the sand': a rescue project of Native Peoples' photographs stored at the Museum of La Plata, Argentina - major project
 EAP234 Identification and description of the colonial documentary fond at the Lima Metropolitan Welfare Society (Sociedad de Beneficencia de Lima Metropolitana)
 EAP298 Preserving endangered ethnographic audiovisual materials of expressive culture in Peru

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Fig. 1: Example of a page from the original EAP website. Image: EAP

essarily an easy task. Retrospective permissions had to be sought from the project holders. Some projects did produce microfilms and these then had to be outsourced to an external supplier for digitisation. The earlier projects had produced beautifully bound hardcopy catalogues that related to the digitised images; these, of course, had to be recreated electronically so that the information could be ingested into the Library's online catalogue. The earlier projects also submitted their material on CDs or DVDs which required the ISO images to be extracted; it was not just a simple task of saving the contents to a server. Even with the majority of the outputs from Phase One being available online, the permissions from the grant holders did not necessarily grant the downloading of the material, so the majority of these projects can still only be viewed from the website.⁹ Towards the end of Phase One and

⁹ EAP now requires the permission forms to be submitted at the detail application stage. This gives EAP a CC-BY-NC license for any outputs from a project.

as part of a review instigated by Arcadia, EAP commissioned the creation of a new website which will be discussed as part of the independent review process.

2.3 Application Process and Panel Observations

The original funding for EAP was 10 million pounds and the assumption was that this sum would enable ten annual rounds of grants. The initial amount actually went a lot further and supported 14 years of the Programme. The format was that EAP could draw down the needed amount each year to cover successful applications. There was no upper limit per round and this meant there were four types of outcomes: an award, a conditional offer, a decline and a deferred decision. The latter was when the applicant had six months to resubmit their application due to the International Advisory Panel being unable to make a decision because of missing information within the submitted form. With the renewal of EAP in 2018 the funding format changed slightly and there was an annual budget limit, making the uncertainty of deferred decisions too difficult to accommodate. Now applicants are encouraged to reapply the following year if the Panel is unable to support an application in its submitted state.

Various trends have been discussed by the Panel throughout the entire duration of EAP. The most repeated is that we have received fewer applications from the Middle East and only six have been funded (projects based in East Jerusalem, Iran, Israel and Lebanon). Although EAP has tried to be proactive in promoting the Programme within the region there has been little noticeable success. Hopefully the recent collaboration with the American University of Beirut as a regional hub will mean that the Programme receives more applications from this region in the future. In the first few rounds of applications for grants the majority were from academics based in Western institutions who due to their research were aware of archival material in poor conditions and at risk of further deterioration. By the fifth round of grants it was noted in the Panel meeting minutes that this was no longer the case and that the majority of applicants were from outside of Europe and North America.

When looking back over the years of Phase One we have been interested to see the conjecture, particularly during the first few years, that the majority of applications had come from outside of the country where the material resided. More recently, with the benefit of data visualisations, we are able to look at these assumptions in more depth. Of course, the truth is always slightly more nuanced, as on several occasions academics may move to western institutions from their country of origin and our statistics do not reflect these distinctions. Although as mentioned above, by the fifth round the Panel was noticing more applications from outside Europe and North America; even in the first year, the distinction was evenly split,

with 49.02% of applications being made by researchers from outside the source country and 50.98% made by local applicants. The second year showed similar figures but from the third round local applicants made up 60.94% of applications. This percentage remained consistent until the funding round of 2021, the first since the outbreak of the Covid pandemic, when 77.94% of applications were submitted by local researchers, with a similar division in 2022 (77.03%). Perhaps one contributing factor for this relatively positive split between in-country and external applications is the high number of applications from South Asia, particularly from India.

It might, however, be more insightful to look at only the successful applications during Phase One, which gives a different picture. EAP awarded 367 projects, with 51.5% of these to applicants in the same country as the archival material. When broken down by some of the major geographical regions it was clear that there was a marked discrepancy in terms of how many were from local applicants: 61.6% of projects in Asia (98 out of 159 projects), 37.5% of projects in Africa (39 out of 104 projects), 44.3% of projects in the Americas (27 of 61 projects) and 60.5% of European projects (23 of 38).

In the very first Advisory Panel meeting held in 2005, it was flagged that the Programme ‘may well get an emergency call during the year to rescue an endangered archive and in these circumstances the Panel would be able to consider the possibility of providing funds without having to wait until the next round of applications. It was agreed that the Programme would consider funding such activities as conservation and freeze-drying, which would not normally be eligible for funding but which may well be required in an emergency situation’.¹⁰ To our knowledge, the Panel was not asked to consider such cases but EAP during Phase Two of its funding did try to address this with limited success and more discussion regarding the Rapid Response grants will be given later in this chapter.

2.4 The British Library’s Relevance to the Programme

The fact that the Library has such a wealth of curatorial staff focussing on the regions and languages that form the basis of EAP projects was factored in at the very start of the Programme:

The success of this Programme will critically depend upon ready access to a wide variety of linguist, cultural, archival, photographic and preservation expertise. The BL is uniquely placed to provide that combination.¹¹

¹⁰ *EAP Round 1 Panel Meeting Minutes* 2005, point 5.1.2.

¹¹ *Agreement between Arcadia and the British Library* 2004, 5.

During the Phase Two discussions this became more concrete as curators within the Asia and Africa Studies section had their job descriptions amended to include 5% of their time helping the Programme (whether by assessing applications, promoting the Programme to relevant audiences or helping with cataloguing queries). The other reasons the Library was chosen to administer the Programme was due to:

- The wealth of professionalism and experience in all aspects of the collection management of manuscripts and archives
- Conservators being world-leaders in the development of treatment for paper and non-paper items
- The Library's experience of storing original material as well as microfilm
- The Library's digitisation facilities
- The Library's experience of administering academic research projects
- As a public body, the Library was known for setting rigorous standards of accounting and financial monitoring

On reflection, perhaps one of the obvious omissions to this list but an understandable one in light of the initial plan to focus on microfilm is the Library's expertise in digital preservation. The team of specialists have guided the EAP team throughout its history in professional standards and tools in order to care for the digitised material, ensuring its stability into the future.

Perhaps one slightly disappointing realisation from the initial agreement and during Phase Two discussions was the wish by Arcadia for the Library to undertake further fundraising 'in order to maximise the research exposure of the archival material and stimulate new project initiatives based upon it'.¹² Within the initial agreement, the Library was to secure additional external funding to sustain the Programme as well as seek shorter-term funding opportunities for hosting academic or archival workshops, seminars or conferences on themes arising out of the material received and to apply for funds for research projects in partnership with the UK higher education sector. It is rather unfortunate the Programme has not yet been successful in securing external funding for these purposes. Now, after 20 years and with over 12 million images online, there is clearly a wealth of digitised material and undoubtedly academics who would want the opportunity to share their research results with others. Below (in section 3.4) we discuss some ways in which these opportunities could be explored further in the future. The Programme has similarly been unsuccessful in exploring consortia partnerships with the USA, which is also highlighted within this chapter.

¹² *Agreement between Arcadia and the British Library* 2004, 13.

2.5 Independent Five-Year Reviews

Arcadia has commissioned two reviews to assess the success of the Endangered Archives Programme. The first, carried out in 2009, was to find out the measurable outcomes of EAP during its first five years and see how far those outcomes met the original expectations held by Arcadia and the British Library. It was to assess any policy changes as well as any recommendations to the process by which the British Library administered the grant. The timing of the review coincided with the Library's creation of a new cataloguing system – Integrated Archives and Manuscript System (known as IAMS) – and the review was to evaluate the impact of this new catalogue on EAP.

The first review acknowledged the timely move of the Endangered Archives Programme from within the Asia and Africa section of the Library to the newly formed Digital Scholarship department as this would ensure the long-term preservation of the material. The main criticism from the review was that although the cataloguing of the material was of high quality, there was a considerable backlog and it was growing with little material available to researchers. The recommendation was that the backlog had to be resolved within two years. A solution for making the material quickly available was to use the website's collection management system. However, this in fact meant doubling the cataloguing as the processes were different for the EAP website and the Library's bespoke catalogue IAMS.

The second review, carried out by Elizabeth Beaudin, former director of Digital Initiatives at the Yale University Library, focussed on the metadata and cataloguing into IAMS and made one fundamental recommendation: the material had to be more discoverable. This was broken down into three main areas:

1. Metadata expansion via a realignment of metadata in use along with additional mandatory elements
2. Training by way of a uniform curriculum for project teams using training materials, in-country user groups and/or a tested training model to advance metadata and cataloguing literacy
3. Upgrades in technology to improve discovery within a new web portal for access to the EAP archives

These recommendations required a policy change for cataloguing within the Library as a whole. Prior to this manuscript titles within IAMS were allowed to be in English or transliterated using the Library of Congress guidelines for non-Roman scripts. Understandably, many of the EAP teams did not have English as a second language nor were they familiar with the Library of Congress guidelines, so the metadata received was not consistent or particularly helpful to researchers. The recommendation from the review was to allow for titles in original script. This was

a game changer, making the digitised material more accessible to the communities most connected with the content.

To address the second recommendation from the review, the listing spreadsheet that captures the metadata and is sent to all projects was improved. The current version of the spreadsheet includes macros to ensure only certain terms (based on the Library of Congress FAST terms)¹³ can be used, ensuring consistency across all projects. The same approach was taken towards the uniformity of Titles of Works rather than, for example, the terms ‘Koran’, ‘Quran’, ‘Qu’ran’, ‘al-quran’ and ‘al-Quran’ all bringing up different search results, which allowed much more discoverability across the collection.

The final recommendation and a requirement ahead of Phase Two funding with Arcadia was to create a new website.¹⁴ The fact that EAP at this point had moved into Digital Scholarship was a significant decision that ensured the Programme was one of the first within the Library to adopt the latest in digital image standards. The website moved from displaying static low-resolution JPEG images to following the International Image Interoperability Framework (IIIF) standard which provided zoomable JPEG2000 images. Most importantly, IIIF allowed the accompanying manifests to be shared within the scholarly community and allowed researchers to annotate content for their own research, share the images and metadata, embed images on other websites and compare different versions of manuscripts on bespoke platforms without the need to receive any copies of the image from the EAP team.

3 Phase Two of the Endangered Archives Programme (2018–2025)

3.1 New Kinds of Grants

The second phase of the Endangered Archives Programme began in October 2018 with funding from Arcadia for five further annual grants rounds. Financially, there was a major difference from the first phase in that the amount of funding available for new projects would be set in advance every year instead of being drawn down as needed (see section 1.1 above). This meant that there would be a limit on the

¹³ See the Library of Congress FAST (Faceted Application of Subject Terminology) terms: <<https://www.oclc.org/research/areas/data-science/fast.html>> (last accessed 17 March 2023).

¹⁴ See <<https://eap.bl.uk/>> (last accessed 22 April 2024).



Fig. 2: Example of static JPEGs available on the first EAP website. Image: EAP



Fig. 3: Example of IIIF image from EAP collection seen through the Universal Viewer. Image: EAP

number of grants given out, however, in practice, EAP continued to fund about the same number of new projects (around 30) every year.

The signed agreement between the British Library and Arcadia recognised a number of challenges facing an international grants-giving programme on the scale of EAP. Of these, the first and most important was ‘reaching potential applicants and enabling them to make good quality applications’. The proposal suggested several ways to address this:

We will increase outreach efforts; provide additional training including videos and materials in several languages; and increase connections between applicants and members of the extended EAP community. The outreach efforts will take advantage of the Library’s international network and curatorial travel on behalf of the British Library to, for example, area studies conferences and regions with endangered materials.¹⁵

The plan for the second phase of EAP included two new types of grants alongside the Pilot and Major project grants which continued from the previous phase:

Area grants

These are the largest projects with budgets initially up to £150,000 lasting up to 24 months. Area grants are similar to a major grant, but larger in scale and ambition. They may cover a larger geographical area, digitise a larger collection, or deal with materials in more challenging conditions. These would allow several related projects from a region or area to be grouped together to give greater impact, efficiencies in training and equipment, as well as economies of scale in project management and coordination. The grouping could be recommended by the Programme, or separate archives could elect to put in a joint or collaborative bid. This model can stimulate collaboration and creative thinking within archival communities, especially where smaller organisations may not have sufficient capacity on their own.

Rapid response grants

These are smaller projects with budgets initially up to £15,000 lasting up to 12 months. These are designed to provide a faster response and may be submitted at any time during the year with a decision made within four months of application. These are targeted at more urgent situations where the delay inherent in the annual cycle could result in extensive damage to the material. These grants would not duplicate initiatives that aim to save or protect collections in an immediate emergency situation, such as environmental disaster, war or civil emergency. They could apply in the aftermath of such events, where collections may remain at continued risk of loss through consequential physical damage or rapid deterioration such as mould after a flood.¹⁶

At the time of writing, EAP has awarded three Area project grants. The first of these, awarded in 2021, was ‘Hidden and endangered manuscript collections connected

¹⁵ *Agreement between Arcadia and the British Library* 2018, 13.

¹⁶ *Agreement between Arcadia and the British Library* 2018, 4.

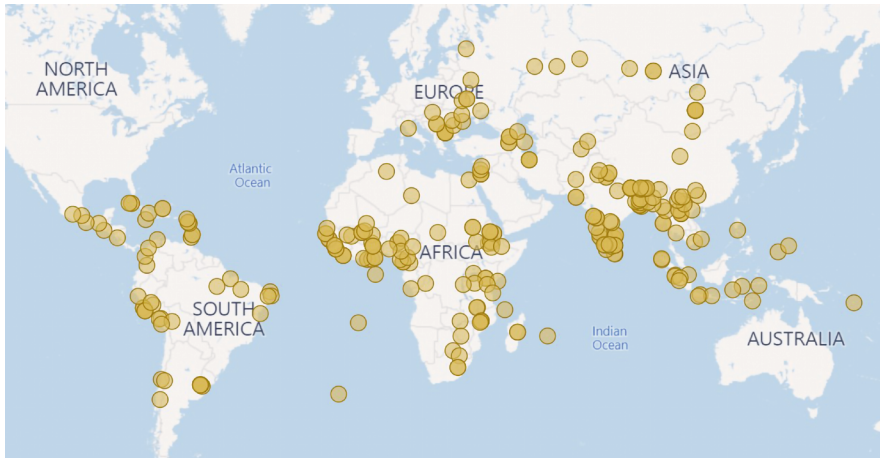


Fig. 4: Locations of EAP projects through to 2021. Image: EAP

to the Supreme Patriarch and the Royal Family of Laos' (EAP1398). This project is working across a monastic complex containing several different manuscript collections in the city of Luang Prabang in Laos. The project lead Khamvone Boulyaphonh had been involved with previous EAP projects and put together a project team comprising people who had been trained in these projects. Also on the project is Volker Grabowsky of Hamburg University who has led EAP projects in the past and is on the Advisory Board of DREAMSEA (see below). This combined experience and expertise makes this ambitious project a realistic one as well.

The results of the ambition to set up a Rapid Response grant have been more mixed. Thanks to its dedicated experts in the fields of conservation and digital preservation, the British Library has been able to give advice and training to those working in emergency situations. However the time, equipment and training needed to set up a digitisation project as well as the institutional support needed to sign agreements and receive grant payments has meant that EAP has not been able to move swiftly enough to accomplish a truly rapid response digitisation project at the time of writing. Ways in which to expedite this process are still being explored, including closer ties with organisations such as Cultural Emergency Response (CER) and the International Alliance for the Protection of Heritage in Cultural Areas (ALIPH), which can move quickly to help stabilise an emergency situation, laying the groundwork for cataloguing and digitising archives.

3.2 Working with Other Programmes

Another big change was the start of a new programme funded by Arcadia, the Modern Endangered Archives Program (MEAP). This programme is based at the UCLA Library and developed from an earlier cultural preservation programme run by UCLA, the International Digital Ephemera Project (IDEP). The Modern Endangered Archives Program joined a growing fellowship of cultural preservation programmes funded by Arcadia which also includes the Endangered Language Documentation Programme (ELDP), the Endangered Material Knowledge Programme (EMKP) and the Endangered Wooden Architecture Programme (EWAP).¹⁷ From 2018 onwards MEAP has operated on the same principles as EAP and other Arcadia-funded programmes, with an annual funding round, an independent panel assessing applications and funding being given to a combination of survey and digitisation projects. MEAP also covers the same broad range of material under the heading of ‘archives’ including photography and sound recordings as well as documents, journals and books.

The main difference between the two programmes, as suggested by the name, is chronological, with MEAP concentrating on more recent endangered material. This meant that while in the past EAP had not put any chronological limits on the material that was in scope we now needed to do so and make clear when applicants should apply to MEAP rather than EAP. In conversations between the two programmes and with Arcadia we decided on the middle of the twentieth century as the dividing line. We now say that applications where the majority of the material dates to before the mid-twentieth century should be sent to EAP, while those where the majority of the material is later should go to MEAP.

This led to another issue: what to do when applicants wanted to work on material that covered both periods and developed applications to EAP and MEAP in the same funding round. We discovered that it was impossible to consider such applications because it was too difficult for applicants to plan and for the panels to assess when it was uncertain whether both applications or only one would be successful. Therefore, along with Arcadia, we decided on a policy of allowing applications to one of the two programmes but not both in the same funding round. In the end we agreed on the following wording:

Applicants with collections including substantial material from before and after the mid-twentieth century can apply to both EAP and MEAP for projects to work on the same collection, but

¹⁷ In recent years, Arcadia has also set up three ‘environmental regranting programmes’: Endangered Landscapes Programme (Cambridge Conservation Initiative); Open Rivers Programme (Stichting Open Rivers); and Earth Investigations Programme (Journalismfund.eu).

not in the same application year. Applicants may therefore choose to create related project plans for their applications to each programme. Funding from one programme must have started before an application to the other programme will be considered.¹⁸

As always, we also suggest that applicants get in touch with us to discuss more complex plans like this and anything else they feel unsure about.

One other digitisation programme with similar goals to EAP is DREAMSEA, another Arcadia-funded programme though not a regranting programme, which has a remit close to that of EAP. DREAMSEA is run by the Center for the Study of Islam and Society) of the Syarif Hidayatullah State Islamic University in Jakarta and the Center for the Study of Manuscript Cultures (CSMC) of the University of Hamburg. The programme seeks to discover and digitally preserve endangered manuscripts in South East Asia. This proactive nature distinguishes DREAMSEA from EAP, which relies on others to identify endangered collections and apply for funding to preserve them.

3.3 Responses to the Pandemic

When the Covid-19 pandemic brought the world to a halt in early 2020, EAP was one of many organisations that had to interrupt something that had been a continuous practice for years. Our sixteenth application round had just concluded and we were preparing for the annual meeting of the EAP Advisory Panel in London. Once it became clear that this was not going to happen we made the decision to postpone the panel meeting (and therefore the funding decisions) to the following year in April 2021. On 23 March 2020 EAP wrote to all applicants now at the stage of detailed application to inform them of this.

In September we wrote again to all current applicants to anticipate whether they still wanted their applications considered in the postponed round, with a survey to assess the amount of changes in project plans and budgets. In October, we came back to all applicants who had responded positively with a link to a Google form to ask whether changes were needed, what they were and for a risk assessment taking into account factors such as travel restrictions and quarantines. As some applicants did not feel able to pursue their original plans and withdrew their application we opened another call for applications to join those that were carried over. In the end there were plenty of viable projects, adjusted or developed in the

¹⁸ Endangered Archives Programme Guide for Applicants, Round 18 (2022). <<https://eap.bl.uk/applicants>> (last accessed 22 April 2024).

light of the pandemic, for the EAP Panel to consider in April 2021. In another first, this was the first time the meeting was held virtually rather than at the British Library in London.

An equally urgent consideration were the 77 EAP projects currently in progress across the world. Institutions closed their doors, staff were furloughed and some of those working on projects fell seriously ill with Covid-19, or had to look after family members who were ill. In London the EAP team was also affected, with the British Library closing and a sudden shift to working from home. Some of us were affected by the virus and could not work for weeks. Trying to understand all of this and develop a response that we could communicate to our projects, we were guided in the first instance by compassion and pragmatism. If EAP-funded projects could not function we wanted to let them know they would have a no-cost extension, initially for three months.

By September of the same year we knew that the pandemic was not going to be over in a matter of months and that brief extensions to projects may not be enough to keep them going. We wrote again to the ongoing projects, now 65 after several that were in the last stages had been able to finish despite the pandemic. This time we were engaged in a fact-finding exercise and asked all project teams to fill in a form with a few questions which would help us understand the changes that were being made or needed to be made so that these projects could continue and hopefully come to a successful conclusion despite the disruption of the pandemic.

1. What stage are you at with your project (e. g. setup, survey, digitisation, finalising metadata)?

Around a third of projects that answered considered themselves to be at the final stage. As long as these project teams had access to a computer and the images they were able to work on metadata and complete all other aspects of their project.

2. Do you expect to need more time than originally planned for? If so, how much?

Ten projects reported they would not need more than the three-month extension already provided by EAP. Others needed longer than they had originally planned, in some cases as much as a year.

3. Do you expect you will need to make other changes to the project plan and material to be digitised?

Around two-thirds of respondents did not anticipate any other changes to the project plan and material to be digitised. Of the others, there were reductions in the ambitions with respect to the number of collections to be digitised or surveyed because of uncertainties around travel.

4. If so, do these changes require adjustments to the project team?

Only four project leads reported that they need to adjust their team. However, a project based in India reported that the team was likely to be dispersed because they had to look for other jobs.

5. What are the financial implications of this (for example: has it been necessary to pay staff salaries/fees from the project funds during a lockdown? Have you had to cancel travel and accommodation bookings?)?

Perhaps surprisingly, around half of the respondents reported no financial implications arising from the pandemic. In some cases the cancellation of travel plans meant that funds could be spent on other aspects of the project. Where projects did incur additional costs it was often in paying the salaries of teams who were unable to work due to illness and lockdowns.¹⁹

As EAP compiled the answers to these questions, local differences in the pandemic were evident, with some projects able to continue to work safely in countries where the pandemic had not yet had a major impact, such as Mongolia. In other countries including India, major lockdowns resulted in staff being furloughed and unable to continue to do digitisation work yet still needing to be paid. Project teams responded to these challenges in varied and creative ways and thus far none had to give up due to the pandemic – a testament to their commitment to the work they were doing. With changes in working plans, communicating via Zoom or similar software and reworking budgets, EAP projects continued to do this vital work.

While the impacts of the pandemic on new projects are currently minimal, some of the processes that EAP introduced in the first year of the pandemic have stayed. We now ask all new projects at the point of receiving their funding offer to review their risk assessment and look at whether any issues have arisen in-between the original application and the point at which the project will actually start. In this way we hope to give project leads the opportunity to let us know whether they will be facing challenges that they did not originally foresee and for EAP to keep better track of changes in places where projects are operating.

3.4 New Opportunities for Research

The increasing depth and breadth of the digital collections created by years of EAP projects has created an incredible resource for researchers. An aspiration expressed in the 2018 proposal for funding to Arcadia was that this would lead to more than new information; it would start to change the way researchers work with the past:

¹⁹ The summaries of the responses are drawn from the report ‘Survey of live EAP projects, September 2020’ by EAP Programme Manager Ruth Hansford.

Furthermore, by taking the EAP approach, we enable researchers to challenge existing narratives and understanding, providing a new lens through which to view the past – one that is uniquely responsive to the needs of communities, researchers, and collection holders.²⁰

While this may seem ambitious, the growing scale of the digital collections funded by EAP (or at least many of them) has started to offer opportunities for a different kind of research in recent years. To take one of many possible examples, we can look at the EAP projects run by Professor Shanker Thapa in Nepal between 2013 and the present. Nepal and the Kathmandu valley in particular has an incredibly rich religious cultural heritage coming from a place where Buddhist and Hindu religious practice coexisted and influenced each other.²¹ Buddhist ritual practices have been handed down through families from one generation to the next over centuries, and many of these practices are recorded in ancient manuscripts. These manuscripts, in the loose-leaf pothi format, are written in Sanskrit and the local Newari language and are mainly kept in the homes of ritual practitioners known as Vajracharyas.

Partly due to its climate, Nepal has some of the very earliest surviving manuscripts in Sanskrit, important for understanding the history of both Buddhism and Hinduism. The richness of Nepal's manuscript tradition was recognised by British colonial residents in the nineteenth century and their acquisitions built the collections that are now held in institutions like the British Library. These collectors selected manuscripts that suited their own interests or were particularly beautiful, early or rare. As a result, the collections held in Western institutions are selective and represent a particular set of nineteenth and early twentieth century European interests. By contrast with this, the EAP funded projects carried out by Shanker Thapa have focused on the collections of those who own and use the manuscripts, who are usually practitioners or ritual specialists.²²

The first project proposed by Thapa and funded by EAP was the survey of Buddhist Sanskrit manuscripts in the possession of Vajrayana Viharas and Newar Buddhist families in Lalitpur in the Kathmandu valley, Nepal (EAP676). As indicated by the title, this was a pilot project surveying personal and monastic manuscript collections kept in the Kathmandu valley. The project digitised and catalogued whole collections of manuscripts and arranged the digital collections in terms of their owners and custodians rather than by other kinds of categorisation. Thus a seventeenth-century illustrated manuscript of the *Kāraṇḍavyūha* sutra (Figure 6) is catalogued as part of the Dipak Vajracharya collection (the inherited collection of a family of ritual specialists) along with 30 other manuscripts in that collection.

²⁰ *Agreement between Arcadia and the British Library* 2018, 18.

²¹ Gellner 1992.

²² Thapa 2015.

Two further projects following up EAP676, and one currently in progress, have generated a truly significant documentation of the manuscript collections of ritual specialists. These collections are very different from, for example, the Hodgson Collection of manuscripts from Nepal at the British Library, taken from various sources and named after its nineteenth century British collector.

Digital collections like those generated by Thapa's projects – and there are many others – mean that researchers can understand the practical content of the manuscripts rather than as individual pieces in a collection stripped of their original lived context. Through this we can begin to see how the ambitions for EAP projects to have a significant impact on research could be realised. Rather than simply adding to the pool of resources available to researchers, EAP digital collections can open gateways to new ways of carrying out research.

This is currently being explored by a recent major research project headed by Mulaika Hijjas and funded by the Leverhulme Trust. The Naskah Sumatra project 'investigates three kinds of manuscript collections – the royal library of Palembang; libraries of private individuals in Aceh; and mosque libraries in Minangkabau – to rediscover the intellectual and literary culture of Sumatra in the 18th and 19th centuries'.²³ The project challenges the dominance of collections created through colonial activities in Southeast Asia – the same dynamic seen in Nepal in the same period:

Most of the manuscripts from the diverse writing traditions of island Southeast Asia that are now held in institutional collections are there as a result of colonial intervention, whether driven by philological or antiquarian scholarship or as the byproduct of conflict between local polities and European agents. Public discourse in Southeast Asia and in Europe increasingly asserts that the displacement of these manuscripts, whether commissioned or looted, was theft, and a deliberate act of violence against indigenous epistemologies.²⁴

This expresses the challenge now present in the availability of new (digital) collections created through the agency and logic of their own custodians rather than selected, removed and categorised through colonial agency and logic. As the recognition of this grows there are surely many other parts of the world where projects like this can be carried out.²⁵

²³ Quote from the Naskah Sumatra project's website, see <<https://naskahsumatra.org/>> (last accessed 10 March 2023).

²⁴ Quote from the Naskah Sumatra project's website, see <<https://naskahsumatra.org/call-for-papers/colonialism-and-manuscript-libraries-in-island-southeast-asia/>> (last accessed 10 March 2023).

²⁵ See also the discussion of these issues in interviews recorded in this video <<https://blogs.bl.uk/endangeredarchives/2022/09/eap-video.html>> (last accessed 14 March 2023).



Fig. 5: Detail from a manuscript of the *Kāraṇḍavyūha* sūtra, from the personal collection of Dipak Vajracharya, Lalitpur, Nepal (EAP676/16/1). Image: EAP

4 Conclusion

At the time of writing the Endangered Archives Programme has supported over 500 projects in 96 different countries. We have surpassed 13 million images available on eap.bl.uk and have over 35,000 sound recordings available via the British Library Sounds website. Reviewing the two decades that have led us to this point, it is striking that it has been a time of great change, especially in terms of technology, global politics and the unexpected crisis of the Covid-19 pandemic. Between 2004 and 2024, the Programme has moved from envisaging preservation as the creation and storing of microfilms to digital photography and providing images and sounds of digitised archives to all via the internet. Some issues have been perennial, includ-

ing the tension between funding archival quality digital preservation projects and swiftly responding to emergency situations where cultural heritage is at risk. Yet the basic principles set out in the early documents we have reviewed remain the same and there is no question that the issues that inspired the founding of the Programme in 2004 are even more present now, with environment and political dangers ever more present to the world's heritage.

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II Preservation Management and National Strategies

Johannes Kistenich-Zerfaß

Managing the Preservation of Originals – Aims, Maxims, Instruments

Abstract: The *National Recommendations for Action* issued by the Coordination Office for the Preservation of Written Cultural Heritage (KEK) in 2015 laid out the challenges to preserving written cultural heritage at archives and libraries in Germany. Tackling these challenges requires effective preservation management which is an interdisciplinary, cross-sectional task for institutions holding cultural heritage. Its primary aim is to plan, implement and evaluate preventative measures – but also conservational and restorative ones – that are needed on the basis of both reliable data and a clear and transparent system of prioritisation among collections, sub-collections and measures. This should be pursued following a structured approach in accordance with applicable standards and financial feasibility so as to permanently preserve – to the extent technically possible – the written cultural heritage in its original form, thus enabling the maximum range of evaluative options. Following this proposed definition of preservation management, this paper will present examples of tried-and-tested concepts and management tools such as the practice of linking damage assessment to the prioritisation of collections or collection segments to draw up work programmes. It will also articulate guiding principles for preservation management and beginning with an assessment of the status quo identify key factors for successful progress over the coming years such as the availability of consulting skills, a needs-based market of service providers and the relationship between preservation and digitisation, although this article will unequivocally emphasise the primacy of the original.

1 Definition of Preservation Management

The trilingual version of DIN EN 15898:2020-02, *Erhaltung des kulturellen Erbes – Allgemeine Begriffe* [Conservation of Cultural Heritage – General Terminology] uses the term ‘preservation’ [Bestandserhaltung] as a synonym for conservation or conservation-restoration – though admittedly in the German-speaking context only – but does not use or define the term ‘preservation management’, however, it is now established and commonly used in the German-speaking specialist discus-

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sion.¹ The use of the suffix ‘management’ may seem pompous or modernistic at first glance but it is employed here with full conviction as the specialist task of preservation fulfils today the defining characteristics of a management process in many cultural heritage institutions: a target-oriented approach in the business sense for which management, organisation, coordination, planning and control are decisive, and this across various professional fields.

As the relevant DIN EN standard has not yet adopted the term ‘preservation management’ this article provides an opportunity to put forward a possible definition for discussion. The following paragraph offers a proposed definition that also formulates the target goal:

Preservation management is a specialist cross-disciplinary task for organisations that preserve cultural heritage. The main focus is primarily on the necessary preventative and conservation/restoration measures. These measures must be planned, implemented and evaluated on the basis of reliable data and a comprehensible and transparent prioritisation of holdings or segments thereof on the one hand and, on the other, measures that take into account relevant standards and economic efficiency. The aim is to preserve the written cultural heritage permanently in its original form – as far as technically possible – and thus make it available for the greatest possible variety of utilisation options.

In this formulation of goals key maxims and instruments of preservation management that have proven themselves in practice will be considered in the following.

2 The Specialist Cross-Sectional Task of Institutions That Preserve Cultural Heritage

Preservation as a specialised task concerns *all* employees in institutions that preserve cultural heritage, not just specialists in preservation as such. Certainly, when thinking of the preservation of cultural heritage, the first thing that comes to mind is conservation and restoration, cultural venues, storage climate or emergency preparedness but there are also overlaps of varying degrees in other specialist tasks. It is worth having a look at the world of archives as an example; preserving cultural assets is also but not exclusively an end in itself because we preserve cultural heritage to ensure access to authentic sources. Conversely, every utilisation poses

¹ DIN EN 15898:2020-02, *Erhaltung des kulturellen Erbes – Allgemeine Begriffe*; Dreisprachige Fassung EN 15898:2019. For a summary of the terms ‘preservation’ and ‘preservation management’ in the context of the specialist discussion in the German archives sector, see Kistenich-Zerfaß 2019.

a risk in terms of preservation; the provision and use of aids for proper handling during use – both within the institution preserving the cultural artefacts and by patrons –, clear guidelines for the transport of archive materials within the institution, between properties, for external exhibition purposes, etc.² are among the key factors in this context as well as the careful creation and online provision of high-quality reproductions, today primarily in the form of digital copies.³ But even if one traces the life cycle of an archival document back to its creation various points of connection with preservation management are evident; cataloguing as a typically serial work process on entire holdings or larger segments of holdings can and should be used consistently to record data on the physical condition of holdings or individual cataloguing units systematically and in a form suitable for efficient database evaluation. In the upstream process of evaluating the archival value and thus the reclassification of written material or documents as cultural heritage, questions of archival suitability must also be taken into account in order to minimise follow-up costs – as far as is technically justifiable – and to document damage patterns that require separation during transfer at an early stage so that a ‘black-and-white separation’ (contaminated/not contaminated) can be made during accessioning. Finally, over the past two decades, the issue of ‘preparatory work’, i. e. advice from the producers of written material, has come back into focus in archives not only with regard to the fundamental challenges posed by e-government but also with regard to so-called analogue documents. We must state self-critically that despite some encouraging steps there is ultimately only very limited success if archives promote the use of age-resistant writing and support materials⁴ in the interests of long-term resource conservation, the proper and professional storage of records and the inclusion of centralised old records, at least in emergency network structures.

As an interim statement, preservation management is therefore about creating awareness of the problem and building competence through advice, training and further education in three areas: among the producers of written documents, among colleagues in our own institution and among our patrons.

The keywords ‘awareness of the problem’ and ‘competence building’ lead directly to the next section of our definition of goals where a look at the basis of Mario Glauert’s still inspiring pyramid model of preservation may be help-

2 Bestandserhaltungsausschuss 2020.

3 DIN 33910:2023-08, *Information und Dokumentation – Objektschonende Digitalisierung von Archiv- und Bibliotheksgut* [Information and Documentation – Object-friendly Digitisation of Archive and Library Holdings]. See also *Archiv- und Bibliotheksgut schonend digitalisieren 2019* [Digitising Archives and Library Materials carefully].

4 Gemeinsames Positionspapier 2015; Gemeinsame Stellungnahme 2019.

ful.⁵ Many institutions, especially smaller ones, that preserve cultural heritage are of course dependent on external advice to build up their expertise. What is lacking is not so much access to basic information but above all secure access to ‘competition-neutral’ specialist advice for specific issues and preservation projects on site. Such an infrastructure is not yet guaranteed across Germany although the structural impetus provided by the special programme for the preservation of written cultural heritage launched by the Federal Government Commissioner for Culture and the Media in 2017⁶ and the activities of the Coordination Office for the Preservation of Written Cultural Heritage (KEK)⁷ over the past ten years has led to a significant increase in the density of the advisory network and new formats of mediation, for example through workshops in individual federal states.

3 Prioritising Preventive Measures

It is as simple as it is crucial: preventing damage is more economical than repairing damage. Therefore, prevention has priority and resources must first and foremost be invested in measures that serve to preserve *as much of the original cultural heritage as possible*. If the conditions for proper storage – the building, storage conditions, storage – are missing, sustainable preservation management cannot succeed; if, for example, a collection were to undergo decontaminating cleaning and then be returned to a damp storage room, resources for conservation and restoration measures would simply be ‘squandered’. But it is also clear that we are already

5 Glauert and Ruhnau 2005.

6 Point 5.2 of the funding conditions for this programme, which is administered by the KEK, requires initial approval at state level; <https://www.kulturstaatsministerin.de/SharedDocs/Downloads/DE/Foerdergrundsaeetze/2023-schriftliches-kulturgut.pdf?__blob=publicationFile&v=1> (last accessed 22 April 2024). This has led to the establishment of new coordination and advice centres in a number of federal states that did not yet have such centres, such as Berlin-Brandenburg (<<https://bestandserhaltung.zlb.de>> [last accessed 22 April 2024]) or North Rhine-Westphalia (<https://afz.lvr.de/de/technisches_zentrum/konservierung_und_restaurierung/konservierung_und_restaurierung_1.html> [last accessed 22 April 2024]) and <https://www.lwl-archivamt.de/de/bestandserhaltung_notfaelle/beratung_bestandserhaltung/> [last accessed 22 April 2024]) and, more recently since 2022, also in Saxony (<<https://www.staatsarchiv.sachsen.de/koordinierungs-und-beratungsstelle-bestandserhaltung-saechsische-archiv-kbb-5647.html>> [last accessed 22 April 2024]) and Schleswig-Holstein (<https://www.schleswig-holstein.de/DE/landesregierung/ministerien-behoerden/LASH/Service/LFB/_documents/202301_lfb_Vorstellung.html?nn=c4c41399-dc48-45e2-a0e0-940730afb1d6> [last accessed 22 April 2024]).

7 See the recently-published specialised information: <<https://www.kek-spk.de/fachinformation>> (last accessed 22 April 2024).

preserving large amounts of damaged cultural heritage, some of which is subject to progressive damage, the long-term preservation of which has to be ‘dearly bought’ by means of conservation and restoration measures. The preservation of original cultural heritage therefore requires long-term stable resources and economic quantity procedures should be prioritised.

4 Conservation and Restoration Measures

The economic framework conditions for successful preservation management and the implementation of conservation-restoration quantity procedures – in particular (decontaminating) cleaning, conservation packaging, mass deacidification,⁸ restoration in quantity⁹ – have improved significantly in Germany. The initiatives of the Federal Government Commissioner for Culture and the Media, the Cultural Foundation of the German Federal States and the KEK over the past ten years have had a catalytic effect in many federal states and have led to a significant increase in funding among institutions for the preservation of original cultural heritage. If subsidies, other third-party funds, budgetary resources for preservation and additional equity capital are added together, the total volume in the public sector (federal government, federal states, local authorities, universities) in Germany in 2021 totalled over 20 million euros (Figure 1) and was therefore about twice as high as nine years previously compared to the figures from 2012 (10.9 million euros), which formed the basis for KEK’s *National Recommendations for Action* and represented around a third of the total requirement of 63.2 million euros per year identified in the recommendations for action as the ‘task of the century’.¹⁰ It should be noted that the

8 Mass deacidification in accordance with DIN 32701, *Information und Dokumentation – Prüfung der Wirksamkeit von Mengenverfahren zur Papierentsäuerung anhand eines Testpapiers* [Information and Documentation – Testing the Effectiveness of Mass Procedures for Paper Deacidification using a Test Paper] is a professionally recognised and proven measure for preserving originals. Applied in good time to papers with sufficient stability, it is the most important and sustainable option for preserving original documents affected by paper decay in conjunction with correct (cold) storage; see as a practical guide *Durchführung von Massenentsäuerungsprojekten* 2019.

9 Restoration in quantity is characterised by the implementation of certain measures using standardised methods and/or techniques on a number of objects that generally exhibit similar damage patterns. Restoration in quantity is typically characterised by process-based procedures, i. e. a division of labour (formulation from a consultation with the KEK Advisory Board from autumn 2022).

10 Following on from guidelines from the 1990s, the aim is to treat at least 1% of damaged written records per year. Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 5, 10, 12, 15, 17.

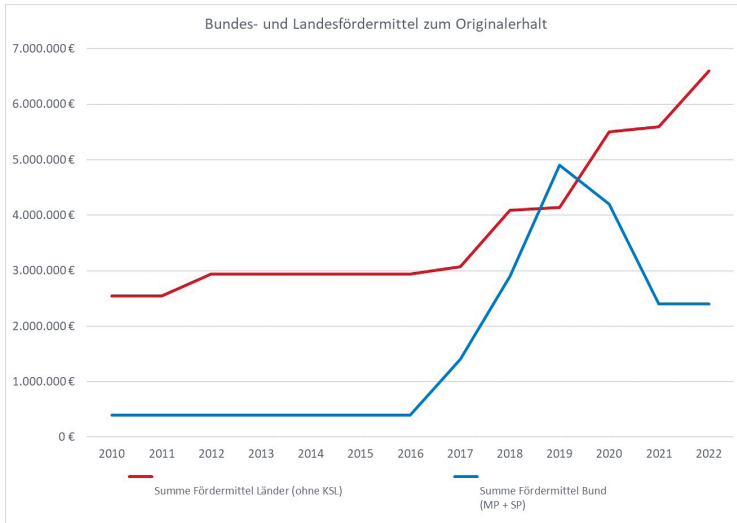


Fig. 1: Increase in funding for the preservation of written cultural heritage since establishment of the KEK. Image: Johannes Kistenich-Zerfaß

Hessian State Archive has achieved the 1% target since 2020 thanks to a significant increase in its equity capital and new state and federal funding in recent years.¹¹

5 Secure Data Basis

The conception and management of this ‘task of the century’ requires a reliable data basis in the institutions that preserve cultural heritage. In addition to planning figures such as boxes per linear metre, average number of sheets per box, target cost rates for certain measures such as packaging, dry cleaning, mass deacidification, full restoration, etc., which are also relevant for other specialist tasks, this also includes an overview of the overall requirement as a ‘political number’ in order to be able to communicate transparently the dimension of the long-term task of preserving originals for society, politicians and superior authorities.¹²

A key instrument here is damage assessment, i. e. a categorisation according to the type and extent of damage from a restoration perspective with a view to the loss of information and substance that has already occurred or (threatens to

¹¹ See *Tätigkeitsbericht 2020*, 26; *Tätigkeitsbericht 2021*, 25.

¹² For further information, see Kistenich-Zerfaß 2018; Kistenich-Zerfaß 2018a.

occur) during use in the institution preserving the cultural heritage. Depending on the holdings, such surveys can be carried out for entire collections (mass uniform preservation condition) in a sampling procedure or by analysing individual objects.

As a rule it makes little sense to differentiate too narrowly between types of damage; rather, types of damage should be categorised straight away with regard to the measures to be taken and the calculation of the costs of measures. Although there are measures that have a 1:1 allocation of damage type and measure (e. g. paper decay → deacidification, ink erosion → phytate treatment) or that are of such high cost that they should be recorded individually, such as objects sealed in film, blocked books or files or massive deformation of entire volumes, measures such as soiling, demetallisation and smoothing of creased pages can ultimately be carried out in one treatment step or workflow ('dry cleaning'). Therefore, these damage patterns do not necessarily have to be documented individually when recording damage.

The relevant differentiation according to the extent of the damage (damage categories) should be based on the question of whether use (internally or by patrons under typical reading room conditions) is possible without the risk of loss of information and/or substance. Three- or four-stage differentiations in the damage categories are possible and have, in practice, been usually made to date, although they are not essential and are not of significant control relevance. Generally speaking, a division into 'restricted use' – meaning need for action – and 'usable' – meaning no (acute) need for action – is sufficient.

6 Easy to Understand and Transparent Prioritisation of Holdings, Segments of Holdings and Measures

If the preservation of original cultural heritage requires stable resources in the long term and if the needs of overall requirements have been determined, a further message is just as important: the preservation of original heritage is 'not a bottomless pit'. Surrendering to the magnitude of the challenge, doing nothing and simply waiting is the worst of all options for cultural heritage which cannot preserve itself. We must take action to preserve cultural heritage, proceed in a planned manner and prioritise holdings or segments of holdings and measures with a view to their sustainability.¹³

¹³ See footnote 12; in the literature cited there also for an overview of the research situation.

In order not only to communicate convincingly the overall needs to society, politicians and funding bodies but simultaneously to demonstrate transparent and practicable solutions, it is necessary to formulate manageable work packages (phase models/work programmes), which should also be oriented towards the planning intervals (e. g. electoral periods) of the funding bodies of institutions where possible. It is therefore a management matter to mediate between the overall requirement and the specific holdings-related measures as an order to an in-house workshop or else an external specialist service provider.

Given the scale of the ‘task of the century’ and the knowledge that the budget for preserving originals is always limited, it is imperative to prioritise. We must prioritise, and we can and do prioritise, in certain contexts as a matter of course, e. g. when deciding on salvage priorities in emergency preparedness. The decision to implement a specific measure with regard to one holding is always possibly a decision to accept progressive damage to another holding. Ultimately, this may mean that cultural heritage can no longer be saved if not treated; in archival terms, a second valuation decision is effectively made.¹⁴ The aim must be to manage the process of preserving cultural heritage in a wise and planned way instead of leaving the chance of preservation to personal preferences, ‘gut decisions’ or ‘natural biological development’. In this context, prioritisation expressly does not mean questioning the principle that cultural heritage is ‘valuable’ without distinction because there is no such thing as a ‘second-class cultural artefact’. But we will only be able to preserve the cultural heritage in its entirety in the long term if we approach the task with convincing strategies or the combination and skilful packaging of various measures.

A few years ago, as part of a pilot project funded by the KEK, we at the Hessian State Archives developed a proposal to this end which develops key figures for the prioritisation of holdings or segments of holdings as well as for preservation measures and sets them in relation to each other in the sense of a risk assessment or relevant risk management methodology.¹⁵ Based on the prioritisation of a holding (segment) according to defined and differentiated criteria, a value is determined that provides a measure for how important it is to treat a particular holding or a specific holding segment in the context of preservation: regarding which holding is it more likely that existing or progressive damage will have to be accepted because it is deferred? Where can we not afford for anything whatsoever to happen and what must be given priority? In terms of risk management, the calculated value therefore makes a statement about the ‘extent of damage’ in the event of non-treatment.

¹⁴ Glauert 2012; Glauert 2014.

¹⁵ For the scheme funded as part of the KEK pilot project, see Adler and Kistenich-Zerfaß 2016. For further development, see the literature mentioned in footnote 12.

The prioritisation of measures relies essentially on the results of the damage assessment but is based on another principle and takes the point of view of the treatment objective, which is ‘as much as necessary, not as much as possible’. Treatment standards must be adapted with regard to the intended future main form and intensity of use. If, for example, a blocked file is to be presented again at a later date in its original form at enormous cost for a full restoration – perhaps due to its outstanding source value –, a different treatment goal and workflow will be chosen than if the leaves and fragments resulting from the separation of the blocked leaves are to be digitised and used in this form as far as possible.¹⁶ Not every binding removed from an official register must be restored because of its intrinsic value; rather, from a cost perspective, one will have to examine whether the binding and quires of the official book could in future be stored side by side.

The following applies to the prioritisation of measures based on the results of the damage assessment: priority is given to the treatment of progressive types of damage such as paper decay, ink corrosion, pieces sealed in film or applied non-ageing-resistant self-adhesive products. A certain middle ground is occupied by old microorganism contamination (mould), which does not represent a progressive damage pattern if stored appropriately but which, with regard to occupational safety issues and the risk of a new outbreak in the event of climatic fluctuations (e. g. in the event of a technical failure), must be kept in mind differently from, for example, soiling or mechanical damage. Volumes massively blocked due to water damage such as the archival holdings affected by the Leine flood in Hanover¹⁷ or the Kahn files in the State Archives of North Rhine-Westphalia¹⁸ cannot be used until they have been treated, but under professional storage conditions they are not at any significant risk of further damage and can therefore be put on hold for the time being.

However, a different picture emerges when the extent of the damage is considered. Measured against this criterion, items are prioritised which have been damaged so badly that they have to be taken out of use.

Based on the damage assessment of a holding or a segment thereof, and the percentage distribution by type and extent of damage, factors can be used to determine a second value (in addition to the prioritisation of holdings or segments thereof) which provides a measure for how severely damaged the holding or the segment

¹⁶ Such considerations were developed, for example, in the context of the large-scale ‘Kahnakten-restaurierung’ project in the State Archives of North Rhine-Westphalia: Kistenich 2011, 52–53. This option is of particular importance in connection with fragments from the Historical Archive of the City of Cologne, which collapsed in 2009; see Fischer and Späinghaus 2019, 89–93.

¹⁷ Goetting 1986.

¹⁸ See footnote 16.

thereof already is and how urgently it must be treated in order to avoid total loss ('probability of occurrence').

The Hessian State Archives additionally include a resource efficiency analysis in the risk assessment based on the prioritisation of holdings or segments thereof on the one hand and measures according to the type and extent of damage on the other according to the maxim: which measure benefits the most archival material per euro spent? A work programme developed on this methodological basis has now for six years been systematically implemented in the Hessian State Archives. This approach has recently been applied successfully to the library division of the state and university libraries in Baden-Württemberg.¹⁹

7 Compliance with Relevant Standards

Hardly any other field of activity of institutions preserving cultural heritage is as comprehensively standardised as preservation, both internationally and nationally, if we think for example of the Hague Convention, the Cultural Property Protection Act, archive and library laws, standardisation at ISO, EN and DIN level, technical guidelines or practical recommendations and model documents.²⁰ This represents an advantage that should not be underestimated: standards strengthen the professional positioning vis-à-vis external partners, form a reliable basis for professional communication and create transparency and commitment in cooperation (for example in connection with public procurement) from service specifications to quality assurance.

In addition, the exchange of best practice and close networking within and between expert committees are a key prerequisite for successful preservation management; with its various dialogue formats, the KEK also plays a key role in this.

8 Cost Effectiveness

Research, investment and innovation are highly desirable both for established bulk treatment processes such as those used in cleaning, mass deacidification and paper stabilisation as well as for newly-introduced processes, and a significant increase in

¹⁹ Recommendation from Christian Herrmann as part of the VIII. Nationwide Expert Meeting on Preservation in Archives and Libraries on 22 September 2022.

²⁰ Relevant for the area of standardisation: Allscher and Haberditzl 2021.

capacity is required to meet overall demand. Successful preservation management depends to a large extent on a corresponding understanding of the role of conservators in cultural heritage institutions, in scientific research and on the service provider market. On-site workshops will continue to be required for consulting, monitoring, ad hoc tasks and the execution of specialised restoration work, support for tenders and work by external service providers, right through to evaluation, etc., albeit with a professional profile that has been undergoing rapid change in recent years.

KEK's *National Recommendations for Action* rightly emphasised the shared responsibility of the federal government, the federal states, the funding bodies of institutions and the institutions themselves.²¹ However, we will not be able to realise the overall need for measures to preserve originals in the limited time available without an efficient service provider market. Conversely, service providers need a minimum degree of planning security in order to invest in capacity expansion, innovative process developments, workflow optimisation, etc. A key element in ensuring that these interests between institutions preserving cultural heritage and the service provider market come into a productive cycle is that the increase in budget and funding for the preservation of originals that has been achieved in Germany over the past ten years is consolidated urgently and expanded further. Just a reminder: from a nationwide perspective, we are at just one third of the required financial volume for the 'project of the century'. Nothing would be more fatal than falling into a 'cycle of failure' in which budgetary and funding resources are cut because the money does not flow due to a lack of market capacity or surmountable obstacles in the processes of funding instruments, thus creating the impression that the resources are not needed in the first place.

9 Original Form and Its Preservation

The highest maxim of preservation management is the primacy of the original in its original form as far as this is technically possible. Admittedly, it must be noted that statements such as 'The original is irreplaceable' and the still similarly formulated legal obligation to preserve cultural heritage no longer represent a self-evident basic consensus in specialist discussion. Germany's largest state archive is taking a different approach here and openly promoting the primacy of digitalisation. First formulated as the result of a comprehensive internal strategy process in the 2018

²¹ Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 8–12.

edition of *Forum. Das Fachmagazin des Bundesarchivs* on the central theme of ‘The Federal Archives in the Digital Age’²² the Federal Archives revealed its repositioning in a technical article published in *ABI Technik* at the beginning of 2021:²³ ultimately, the Federal Archives are effectively pursuing a strategy of ‘substitute digitisation’ for a large part of their holdings and are deliberately foregoing measures to preserve the originals.²⁴ The *Bestandserhaltungskonzept des Bundesarchivs* [Federal Archives’ Preservation Concept] which was published online at the beginning of 2022 is aligned accordingly.²⁵ Germany’s largest public archive thus interprets the requirement under Section 3 (1) of the Federal Archives Act to ‘safeguard’ cultural heritage in such a way that at least for the major part of its holdings a digital copy fully replaces the original in the long term; authenticity and source value thus do not require originals.²⁶ The Federal Archive rules out established methods of bulk treatment such as mass deacidification and only envisages other measures such as packaging in the downstream process of digitisation. The alternatives mentioned such as cold storage are not fleshed out and are unlikely to be realisable in the near future in times of energy shortages and taxation; essential questions about long-term secure storage for the replacement digital copies and the eternal costs for gigantic amounts of image data remain unanswered; instead, one argues and calculates with a perspective of ten years, which, for archives at least, is unusually short.²⁷

The discussion about the primacy of the original versus the primacy of the digital has thus also been initiated in the German specialist community and the

22 Hänger and Hollmann 2018, 20–22.

23 Hänger et al. 2021; Boden et al. 2023.

24 A few excerpts from the technical contribution may clarify the position: ‘This means [...] that objects created in the digitisation process are not just copies, but are manifestations of the original and can ultimately also replace the original. Building on this, Michael Hollmann deduces that the cultural value of the original is not primarily determined by its materiality, but by the characteristics associated with it by other people. [...] This is exclusively about operationalising the strategic decision for the primacy of the digital, about economic implementation and the ensuring of integrity, authenticity, provision, long-term security and access authorisation. [...] Digitising the core holdings is the only way to secure the content of the records in the long term and prevent the loss of information. [...] In the long term, it is not possible to digitise a large number of records and, at the same time, finance costly measures for the preservation of the originals of the entire holdings’. Hänger et al. 2021, 79–80, 82, 85. [Translation C. O’Neill].

25 *Bestandserhaltungskonzept Bundesarchiv* 2022.

26 Special measures are to be applied to individual ‘core’ or ‘lead holdings’ that have not been defined in more detail; see e. g. Hänger and Hollmann 2018, 22; Hänger et al. 2021, 80; Boden et al. 2023, 40.

27 Hänger et al. 2021, 85.

fundamental question of the importance of preserving originals has been raised. Meanwhile, the KEK Advisory Board has positioned itself publicly in favour of the primacy of the original.²⁸ Needless to say, original preservation *and* digitisation (in this order of priority) should and must go hand in hand: high-quality digital copies created in a way that preserves the originals, protects the latter and at the same time increases availability and ease of use.²⁹ However, anyone who believes that the primacy of the original must be abandoned in favour of the primacy of the digital is accepting the total loss of cultural heritage on a massive scale and has ‘capitulated’ unnecessarily in the face of at best vaguely foreseeable future consequences to a solvable task: managing the preservation of the original.

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²⁸ Frohmann et al. 2023.

²⁹ Of course, there are media for which replacement digitisation is required in the short term in order to ensure the preservation of the information, either because they are subject to irreversible, rapid processes of decay or because there is a lack of reproduction options, playback devices, etc.: colour photographs, magnetic tapes, obsolete video formats, etc. In addition, there are holdings for which an objective discussion about replacement digitisation can and should indeed be held due to the advanced state of damage and/or the large-scale uniformity, if one thinks, for example, of the far more than 10 linear kilometres of data entry sheets from the 1950 census in Germany.

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Michael Fischer

Cooperative Preservation – The Regional Legal Deposit Copy as a Basis for a Mass Deacidification Strategy

Abstract: The German National Library and the state and regional libraries each collect, catalogue and archive a legal deposit copy of all media published within their respective territorial jurisdiction. In its *National Recommendations for Action* the Coordination Office for the Preservation of Written Cultural Heritage (KEK) recommends that the legal deposit libraries be tasked with safeguarding written matter printed since 1851 in accordance with their current responsibilities in the German states. Regardless of the deposit regulations that were in place historically, these libraries should assume a duty of preservation for printed matter published in the territory for which they are responsible today. Because in many cases multiple copies have survived the deposit copies must first be identified in the libraries' catalogue systems and be designated as the archival copies to be preserved in all circumstances. These legal deposit copies should then be given priority for deacidification.

The discussion about the permanent archiving or the discarding of printed literature has gained momentum in recent years, both internationally and in Germany.¹ The main models discussed are those that aim for 'systematic, rule- and data-based cooperation'² and follow the tradition of 'cooperative or division of labour solutions' in the German library system.³ A model of this kind was implemented at the Baden State Library in 2020–2021 as part of the bwLastCopies project in Baden-Württemberg which has created a reference for a cooperative preservation and mass deacidification strategy based on the regional legal deposit copy.

1 Overview in: Altenhöner et al. 2020; Schüller-Zwierlein 2021.

2 Altenhöner et al. 2020, 1.

3 Altenhöner et al. 2020, 1.

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1 The Legal Deposit Copy: Legal Basis and Stakeholders in Germany

The (printed) national cultural heritage in Germany is collected, catalogued and archived within the framework of a mutually complementary overall system of libraries. In addition to the German National Library and the state and regional libraries this is based on central specialised libraries, large research libraries and university libraries. The library networks and the journal database (ZDB) are also important stakeholders.⁴

The national and regional legal deposit copy collected by the German National Library and the state and regional libraries can serve as a ‘first point of reference’⁵ for cooperative preservation measures. Two copies (at least) of each published media work must be deposited in the responsible deposit libraries: one in the German National Library at federal level and one in the relevant state or regional library at local level.

At federal level this legal deposit is regulated in the German National Library Act (DNBG) and with it the collection, cataloguing, bibliographic indexing, permanent safeguarding and making available for use of all media works published in Germany since 1913.

There are legal deposit regulations also at federal state level which are implemented by the respective state and regional libraries. In Baden-Württemberg, one copy must be deposited in the Baden State Library for the Baden part of the state and one copy in the Württemberg State Library for the Württemberg part of the state on the basis of the 1976 Act on the Deposit of Legal Copies [Gesetz über die Ablieferung von Pflichtexemplaren].⁶ The state libraries are responsible for the permanent archiving and preservation of the legal deposit copies submitted, while in the other federal states the state or regional libraries fulfil the legal deposit regulations of the respective federal state. For example, the Saxon State and University Library Dresden (SLUB) collects, catalogues and archives the Saxon legal deposit copy and the Mecklenburg-West Pomerania State Library Günther Uecker in Schwerin does so for the Mecklenburg-West Pomerania legal deposit copy.

Based on the regional deposit copy, the state and regional libraries are the central stakeholders responsible for a holdings preservation strategy and measures for mass deacidification within Germany. They preserve the written cultural herit-

⁴ Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 13–15.

⁵ Altenhöner et al. 2020, 2.

⁶ The Baden State Library is responsible for the administrative districts of Freiburg and Karlsruhe, the Württemberg State Library for the administrative districts of Stuttgart and Tübingen.



Fig. 1: Legal deposit libraries in Germany. Image: NordNordWest, CC-BY-SA 3.0

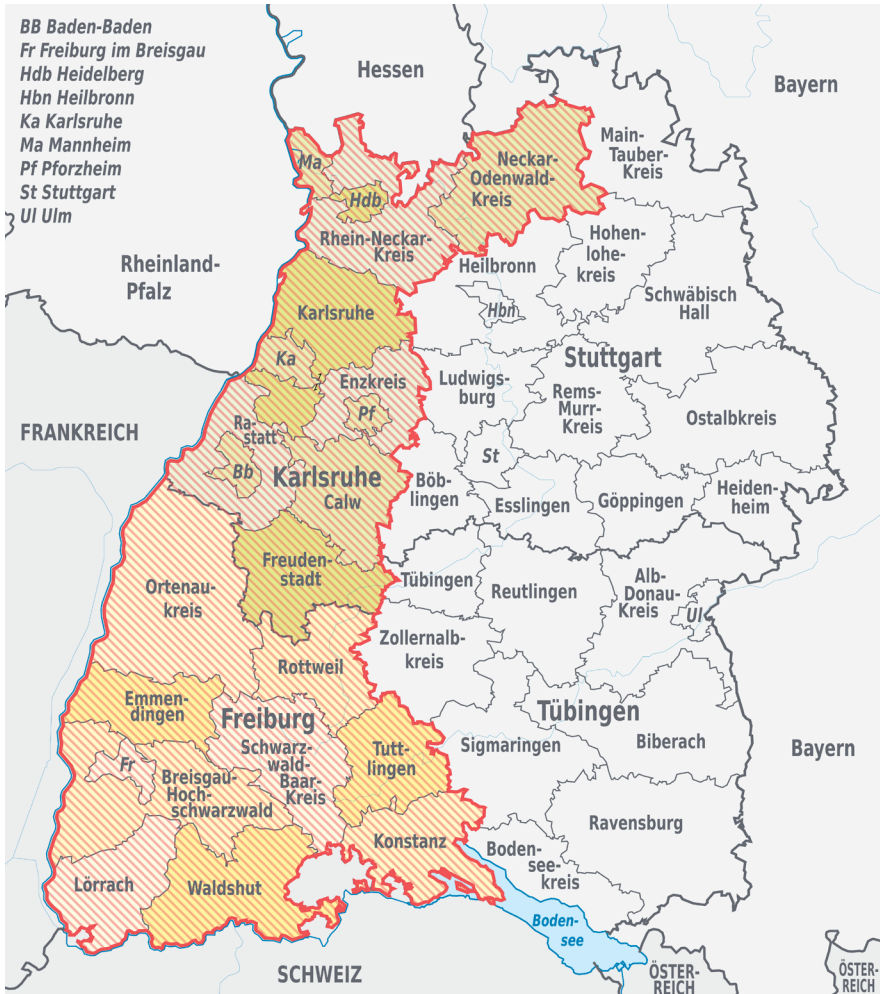


Fig. 2: Territorial responsibility of the Baden State Library for the Baden-Württemberg legal deposit copy. Image: Baden State Library, CC-BY-SA 3.0

age of their respective regions and collect all publications whose content deals with the respective region as well as all titles that are published in the respective region – the regional deposit copies mentioned above. The Baden State Library accordingly collects, catalogues and archives all media works published in the Baden region of Baden-Württemberg, irrespective of whether they are published by a publishing house or self-published by an authority, an association, an organisation, a company or a private individual. In this way, the entire media production

of a state is collected in one place and is securely archived in public ownership as cultural heritage and as a research source for posterity. The proportion of total acquisitions of (here: printed) media is considerable; in 2021, the proportion of total acquisitions added to the holdings of the Baden State Library via the legal deposit copy was around 53%.⁷ The Württemberg State Library fulfils this task for the Württemberg region.

2 Prioritisation and Coordination of Conservation Measures

In 2015, the KEK published *National Recommendations for Action for the Preservation of the Written Cultural Heritage*. In this document, the KEK prioritised the library holdings to be treated as part of the preservation measures and made recommendations for coordinating the measures.

Unique library holdings, e. g. manuscripts, autographs, bequests or prints of intrinsic value, no matter what must be ‘preserved in their entirety in the original for future generations’⁸ and must generally be safeguarded with suitable preservation measures. However, since the invention of printing, written material is generally available in libraries in multiple locations so that its preservation in libraries must be prioritised according to the respective central responsibility; based on the recommendations of the Alliance for the Preservation of Written Cultural Heritage [Allianz Schriftliches Kulturgut Erhalten] from 2009, the KEK states that every ‘surviving copy’ of books printed up to 1850 ‘regardless of their language, place of printing or storage’ should be preserved, as each volume has an ‘intrinsic value’ due to individual production or traces of collection and use.⁹ All unique library holdings as well as all printed books published before 1850 are therefore subject to the ‘overall responsibility of all institutions and funding bodies’.¹⁰

From around 1851, however, books were produced by mass production and in ever larger editions so that from this point onwards a ‘permanent preservation of the complete multiple transmission [...] is unrealistic for cost reasons’,¹¹ which is

7 Baden State Library 2022. Statistic, <https://www.blb-karlsruhe.de/files/user_upload/PDF/1_Die_%20BLB/2021_Statistik_fuer_Website_mit_Logo.pdf> (last accessed 26. July 2024).

8 Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 49.

9 Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 51.

10 Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 50.

11 Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 50–51.

why the KEK proposes a ‘shared responsibility’¹² for all printed books published from 1851 onwards:

German prints from 1851	State and regional libraries of the federal states and academic municipal libraries
German and German-language prints 1851–1912	University Library Johann Christian Senckenberg Frankfurt a.M. (Collection of German Prints 1850–1870) Berlin State Library – Prussian Cultural Heritage (Collection of German Prints 1871–1912)
German and German-language prints from 1913 onwards	German National Library
International prints 1850–1949	Bavarian State Library Berlin State Library – Prussian Cultural Heritage
International prints 1950–2013	[former] Special Subject Libraries of the German Research Foundation
Rare and valuable prints from 1851 onwards of intrinsic value and/or collection relevance	Owning institutions, e. g. academic municipal libraries

The state and regional libraries are responsible for safeguarding the respective regional legal deposit copies published from the year 1851 onwards, according to the present territorial responsibility of the respective library.¹³ Nationwide (relevant for mass deacidification for the period 1851–1990), this affects a total of around 3.7 million regional legal deposit copies in the holdings of German state and regional libraries.¹⁴ At the Baden State Library this includes approximately 210,000 legal deposit copies from Baden, multiple copies that would have to be deacidified en masse as part of the preservation measures.

In order to be able to identify the regional legal deposit copies they must first be labelled in the library reference systems, however; this task is made more difficult by the structure of library reference systems in Germany; unlike in Switzerland, for example, there is no standardised reference system at national level but rather a total of six library networks, each with its own network databases,¹⁵ although since 2019 the library holdings of ten federal states have been searchable in a joint

¹² Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 50.

¹³ Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 23.

¹⁴ Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts 2015, 28. In addition, there are around 5.2 million volumes in the holdings of the federal institutions.

¹⁵ The six library networks are: Bibliotheksverbund Bayern (BVB), Südwestdeutscher Bibliotheksverbund (SWB), Gemeinsamer Bibliotheksverbund (GBV), Hessisches Bibliotheksinformationssystem

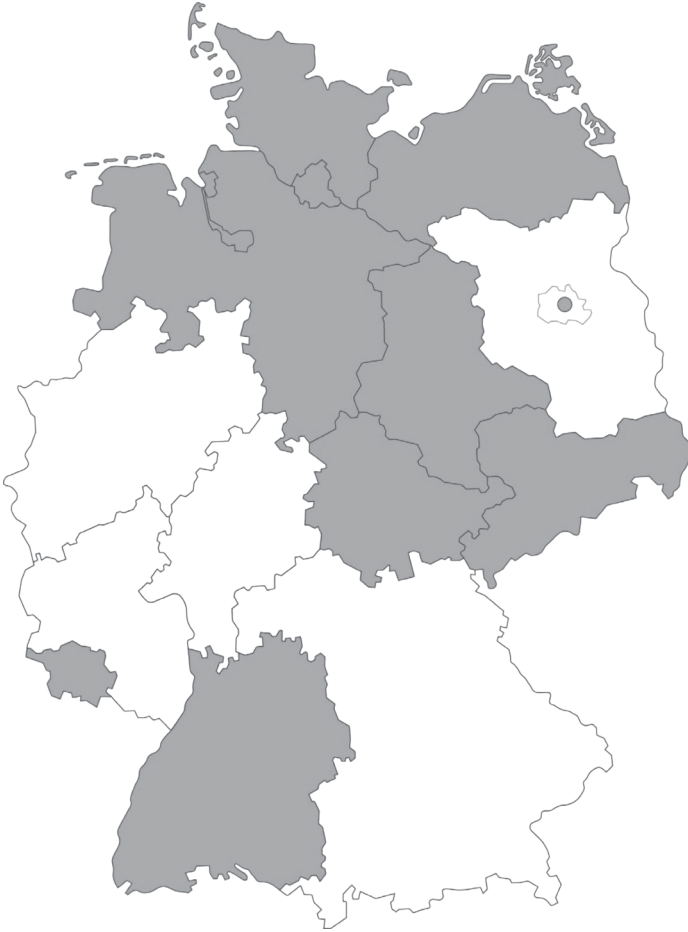


Fig. 3: K10plus federal states. Image: BSZ-GBV-Wiki zu K10plus, URL: <<https://wiki.k10plus.de/>>, last accessed 9 November 2023

reference system with the K10plus database. K10plus was the technical data basis for the project presented here.

The steps that would have to be taken to implement a mass deacidification strategy based on the regional legal deposit copy are explained below using the Baden model.

tem (hebis), Kooperativer Bibliotheksverbund Berlin-Brandenburg (kobv) and Hochschulbibliothekszenrum des Landes Nordrhein-Westfalen (hbz).

3 Data Model for Preservation Measures and (Long-Term) Archiving

Since the topics of cooperative preservation and removal from circulation have increasingly found their way into the specialist library discussion, it quickly became apparent that an important element for supra-regional and cross-institutional coordination was missing, namely the possibility of a centralised record of archiving obligations and preservation measures in the library network systems.

On the initiative of the Speicherverbund Nord,¹⁶ a regional association of seven northern German libraries for the joint archiving of printed journal holdings, the KEK in 2016–2018 supported the Einheitlicher Nachweis [Standardised Proof] project as part of which a data model for the standardised exchange of information on preservation measures and archiving agreements was developed and which is now firmly established in the German network systems and in the Zeitschriftendatenbank (ZDB).¹⁷

As PICA field 4233 for ‘Holdings Protection Measures and (long-term) Archiving’, this data model corresponds to MARC field 583 and thus complies with the international standard. The sub-field structure for use in the German network systems is as follows:

PICA 4233	PICA+ 046X	Repeatable	Contents	MARC 583
\$3	\$3	no	Holdings information Form: according to the local information in the holding area	\$3
\$a	\$a	no	Code for the measure	\$a \$2
\$c	\$c	no	(planned) date of action Form: YYYYMMDD, YYYYMM, YYYY	\$c
\$f	\$f	yes	Context/legal basis Form: (standardised) text or ISIL	\$f
\$h	\$h	no	Legal responsibility Form: ISIL	\$h
\$i	\$i	no	Method Form: Code for procedure	\$i

¹⁶ Der Speicherverbund Nord, <<https://fachwelt.sub.uni-hamburg.de/archivierung/der-speicher-verbund-nord.html>> (last accessed 6 March 2023).

¹⁷ See Geisler et al. 2020.

PICA 4233	PICA+ 046X	Repeatable	Contents	MARC 583
\$k	\$k	yes	Executing agent Form: ISIL	\$k
\$l	\$l	yes	Damage images Form: Text	\$l
\$z	\$z	no	Comment Form: Text	\$z
\$5	\$5	no	Library/Institution Form: ISIL	\$5

At title data level, the following kind of information can now be entered in PICA field 4233:

- A code that defines the action and its status, e. g. whether a title is permanently archived ('aa'), already mass deacidified ('ba') or whether digitisation is planned ('cb').
- The respective context or legal basis of the action, e. g. whether the title is labelled as permanently archived as part of a legal deposit copy regulation, a special collection or as part of a FID collection. The code for the Baden-Württemberg legal deposit copy, e. g., is 'PEBW'.
- If a title has been marked as mass deacidified the method used for deacidification can be entered in another subfield, e. g. 'METE' for 'magnesium ethanolate' and 'titanium ethanolate' or 'MgO' for 'magnesium oxide'.
- In a further subfield the library responsible for the respective action is entered with its call number, e. g. 'DE-31' for the Baden State Library.

A permanently archived Baden legal deposit copy title in the holdings of the Baden State Library is labelled as follows and can be searched for as:

\$aaa\$fPEBW\$5DE-31

The PICA field 4233 can be used multiple times, i. e. several archiving obligations or inventory protection measures can be recorded here. The establishment of PICA field 4233 in the network databases makes it possible to label the regional legal deposit copies at title data level as described above and thus in turn creates the basis for a mass deacidification strategy based on the regional legal deposit copy.



Fig. 4: PICA title data record for: Taine, Paul: *Lazarus, komm heraus! Die Geschichte eines jüdischen Mannes, der zur Ehre Gottes vom Tode auferweckt wurde*, Baden-Baden: Feigenbaum-Verlag 1966. Image: Baden State Library

4 Identification and Labelling of the Baden Legal Deposit Copies as Part of bwLastCopies

The Baden State Library has put this into practice as part of the Baden-Württemberg state project bwLastCopies; all Baden legal deposit copies have been labelled as permanently archived in PICA field 4233,¹⁸ which happened following the KEK's proposals of 2015, retrospectively from the year of publication 1851 and on the basis of today's (and not historical) territorial jurisdiction. The 2019–2021 bwLastCopies project at the Baden-Württemberg Library Service Centre (BSZ) aimed to set up and commission a holdings management system to enable cooperative removal from circulation and preservation; among other things, (potentially) rare titles were flagged in PICA field 4233 and the Baden and Württemberg legal deposit copies were labelled as such a part of this project which is limited to academic libraries in the state of Baden-Württemberg.¹⁹

The legal copies in Baden from 1851 onwards could only be identified in the K10plus network database by their place of publication. In so doing, every title from 1851 onwards with a place of publication in Baden was considered a legal Baden copy regardless of any historical legal regulations that may have existed in the past. To do this, a list of as many Baden-Württemberg towns as possible had to be compiled from various source systems in a laborious process, with the list of places that

¹⁸ Fischer et al. 2021.

¹⁹ Potentially rare titles in this context are titles that are still to be found in one, two or three libraries under the auspices of Baden-Württemberg. For bwLastCopies, see Gerland 2021.

was then used containing more than 10,000 place names including many reference forms and differing spellings. The BSZ used this list to search the entire holdings in the K10plus network database and to compile a list of all monograph titles published between 1851 and the present with a place of publication in Baden-Württemberg.²⁰

In reality, however, only around 80% of the titles identified in this way are actual legal deposit copies in the holdings of the legally responsible library, i. e. the Baden State Library. These titles were labelled Baden legal deposit copies in PICA field 4233 as described above.

The remaining approximately 20% are held as virtual legal deposit copies in the holdings of other libraries in Baden-Württemberg. There are two reasons for this:

1. Between 1868 and 1936 the legal regulations on the legal deposit copy in Baden were suspended, which is why a large part of the Baden written heritage did not even find its way into the holdings of the Baden State Library.
2. Even printed works that were added to the holdings of the Baden State Library during this period are no longer preserved because the library suffered a total loss of its holdings of printed works during a bombing raid in September 1942.

These virtual legal deposit copies also had to be labelled as Baden legal deposit copies which involved coordinating the assumption of archiving duties with the owning libraries. An obligation algorithm was developed in order to determine which library under the auspices of the state of Baden-Württemberg should logically assume a preservation obligation for one of these virtual legal deposit copies. Whenever a legal deposit title from Baden was not in the holdings of the Baden State Library, the latter checked whether the title was available in the nearest library in the following order:

- Württemberg State Library
- University Library Heidelberg
- University Library Freiburg
- University Library Mannheim
- KIT Library Karlsruhe
- KIM Konstanz
- University Library Tübingen
- University Library Stuttgart
- KIM Hohenheim
- KIZ Ulm

²⁰ Only printed works and no parent bibliographic records, magazines or newspapers were included in the search.

The order of the libraries resulted from the historical and current legal responsibilities for the Baden or/and Baden-Württemberg legal deposit copy; the legal deposit copies of the present-day state of Baden-Württemberg have always been collected by the Württemberg State Library and the Baden State Library on a complementary basis. Periodically, the university libraries in Freiburg and Heidelberg exercised their own legal deposit copyright for the Grand Duchy of Baden, and from 1945 to 1964, Freiburg University Library had the legal deposit copyright for South Baden which was founded in the French occupation zone with Freiburg as its capital.²¹ The university libraries were followed by all other libraries under the auspices of Baden-Württemberg in the order of the list of call numbers. This complex obligation algorithm comprised almost 100 library call numbers and analysed data spanning a period of approximately 170 years.

In January 2021, the directorates of the participating academic libraries in Baden-Württemberg agreed to the automated entry of the archiving obligation in accordance with the obligation algorithm outlined above for the Baden legal deposit copies held in their libraries' holdings by means of a *Draft Resolution of the BLB on the Cooperative Recording of a Preservation Obligation for the Virtual bwlegal Deposit Copy 1851 ff in K10plus*.²² In the event of a removal from circulation the title in question must be offered to one of the responsible state libraries for acceptance. The virtual Baden legal deposit copies were subsequently labelled in PICA field 4233 as:

\$aaa\$fPEBW\$hDE-31\$5< ISIL of the owning library >

As part of bwLastCopies a total of approximately 441,000 physical legal deposit copies from Baden and approximately 109,000 virtual legal deposit copies from Baden were labelled. Since then the Baden legal deposit copies have been labelled in PICA field 4233 in the current acquisitions of the Baden State Library.

Titles that have a place of publication in Baden but are not subject to legal deposit, namely all 'genuine' dissertations and other university publications, were not labelled legal deposit copies from Baden. According to a resolution of the Standing Conference of the Ministers of Education and Cultural Affairs [Kultusministerkonferenz (KMK)] also in Baden-Württemberg, the university at which the dissertation was submitted is obliged to archive dissertations. The university libraries in Baden-Württemberg are currently labelling 'their' dissertations in PICA field 4233; at present, 190,211 dissertations at Baden-Württemberg university libraries are already labelled in the K10plus network database.²³

21 For the history of the legal deposit law in Baden, see Hiller von Gaertringen 2021a.

22 Hiller von Gaertringen 2021b.

23 As of 30 October 2023.

Set 2 | Setgröße 1 | Datensatz 1 | PPN 1154724379 | Format D

Eingabe: HDUB:03-05-00 Änderung: BSZ:18-05-22 14:11:43 Status: 9999:07-12-05

0100 1154724379
 0110 084724374
 0500 Aau
 0501 Text\$btxt
 0502 ohne Hilfsmittel zu benutzen\$bn
 0503 Band\$bnc
 1100 1950\$n1950
 1500 ger
 2098 #OCoLC#19603900
 2240 BSZ: 084724374
 3000 Steibelt, Margrit
 4000 Das @späte Mittelalter\$hvon Margrit Steibelt
 4030 Heidelberg\$nKerle
 4060 45 S.
 4170 Geschichtliche Grundrisse
 4171 Heidelberger Texte\$hGeschichtliche Reihe
 4233 \$aab\$sc20200919\$fDE-640\$z2
 4233 \$aaa\$fPEBW\$hDE-31\$DE-16

Fig. 5: Example of a virtual legal deposit copy from Baden in the holdings of Heidelberg University Library. PICA title data record for: Steibelt, Margrit: *Das späte Mittelalter*, Heidelberg: Kerle, 1950. Image: Badische Landesbibliothek

Since such extensive and complex mass labelling can result in incorrect labels, subsequently several automated clean-up operations were necessary. Among other things additional legal deposit copies were labelled (e. g. in the case of ecclesiastical university libraries that have voluntarily entered into a preservation obligation) and corrections entered (e. g. the cancellation of the preservation obligation in the case of loss of holdings or legal deposit titles still to be acquired). Another problem is dealing with homonymous places of publication that exist both within and outside Baden-Württemberg, e. g. Brühl (NRW), Lichtenau (NRW) or Neuried (Bavaria). In the context of the place list search, titles with such places of publication were identified as legal deposit copies from Baden even when these places were not located in Baden-Württemberg. The title records in question were corrected as far as possible.

The Württemberg legal deposit copies in the area of responsibility of the Württemberg State Library – with a reverse obligation algorithm – could also be labelled within the framework of bwLastCopies as described here.

5 Conclusion: What Was Accomplished by the Pilot Project at the Baden State Library?

First, the labelling in PICA field 4233 provides a reliable indication of the number of Baden legal deposit copies that have to be mass deacidified as part of preservation measures, namely a total of approximately 210,000 for the relevant period 1851–1990.

Second, there is a precise, title-specific classification for the Baden legal deposit copies to be treated as part of a mass deacidification measure. The logistical basis for such a programme must be created at the Baden State Library and applications then formulated for the KEK and other possible funding bodies.²⁴

Third, the pilot project can be the starting point for a nationally-structured, complementary and cooperative general system of preservation. In order to be able to implement an effective preservation strategy based on the regional legal deposit copy the legal deposit copy titles in the holdings of the other state and regional libraries must also be labelled in the library reference systems in PICA field 4233 in the same way as in the Baden pilot project presented here. Supra-regional cooperative archiving commitments and agreements between the state and regional libraries of other federal states are now possible; with K10plus, they already have a common database in ten out of 16 federal states. Currently, for example, as part of the NI-LastCopies project in Lower Saxony, the legal deposit titles in Lower Saxony from 1850 onwards are being identified with archiving obligations coordinated and entered in PICA field 4233.

If this labelling were implemented by all eligible state and regional libraries for their regional legal deposit copies the basis would be created for a comprehensive and effective general cooperative preservation system that ensures that no title is removed without first being offered to the responsible regional legal deposit library for acquisition and that exactly one copy of each title, namely the regional legal deposit copy, can be mass deacidified.

Only time will tell whether preservation in the sense presented here will remain a voluntary obligation on the part of libraries or whether it will be formulated as a political mandate in the future. In any case, a general system of cooperative preservation will be able to rely essentially on the state and regional libraries.

²⁴ In the years 2017–2021, the Baden State Library has already had holdings from the Upper Rhine regional history collection area, which was managed separately until 1974, deacidified and received grants for this purpose from the KEK from special federal funds for the preservation of written cultural heritage in Germany and budget funds from the Baden-Württemberg state restoration programme.

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Agnes Blüher and André Page

Mass Deacidification at the Swiss National Library

Abstract: Forty years ago anxious archivists and librarians coined the catchphrases ‘paper decay’ and ‘acidic corrosion’ and thus brought the preservation of archival and library holdings to public attention. The quantity of threatened cultural heritage prompted scientists and technicians to develop a wide variety of mass deacidification methods. Mass deacidification serves memory institutions as a means of preserving originals and also functions as a beacon which signals that conservation must be perceived as a core task and provided with the necessary resources. In Switzerland the Federal Archives and the National Library (NL) opted for the papersave® process in 1995 which was implemented in the papersave swiss facility and available to all interested parties in Switzerland until 2022. During the years 2000–2014 the NL treated all collections intended and suitable for deacidification. The quality assurance concept included long-term monitoring of the treated holdings; over the observation period of currently seven to twenty years, the deacidification treatment proved to be sustainable and stable in 97% of cases. Mass deacidification is an intervention in the original substance and cannot be reversed or repeated. The responsible selection of holdings and deacidification methods, for which international standards and sufficient experience are now available, is of decisive importance.

1 Initial Situation

Since the 1970s libraries and archives had increasingly noticed papers that were ageing rapidly and becoming brittle and the responsible librarians and archivists feared the worst and raised public alarm. Journalistic-effective catchphrases were coined such as ‘acidic corrosion’, ‘paper decay’ and ‘paper crumbles to dust’, which may be found in numerous press articles in North America and Canada in the early 1980s and in Europe in the 1990s.

Given the scale of the threat, the aim was to develop ‘mass processes’. Scientists dreamed of inexpensive processes to neutralise acids in paper, combined with a stabilisation of the paper and even the fumigation of entire storage facilities; of the

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numerous processes that were developed only a few reached the practical stage and even fewer have proved successful in the long term.¹ From the outset the sponsors and users of mass deacidification were the large national archives and libraries.²

The problem also moved to the fore in Switzerland. At the beginning of the 1990s the Swiss National Library (NL) redefined the word ‘conservation’ to mean active and scientifically supported care of the original. As the name suggests, mass deacidification is a major conservation measure that requires a high level of financial and human resources, with its implementation requiring interest and personal commitment at both management and political level. The mass deacidification in the NL – as in many other national memory institutions – became a beacon signalling the way forward: our institution sees the preservation of originals as a core task. In retrospect, the predicted catastrophe of ‘paper decay’ turned out to be real but smaller in scope and more complex to manage than expected.

2 The Papersave Swiss Facility in Wimmis

The Bernese conservator Erwin Oberholzer has been working on mass deacidification at the Swiss Federal Archives since 1982. The ‘mass deacidification’ project was given the necessary political weight through cooperation between the Federal Archives and the NL; after a joint evaluation phase the decision was made in 1994 in favour of the papersave® process of Battelle Ingenieurtechnik GmbH which was subsequently developed into the papersave swiss process. This process is a non-aqueous liquid-phase process which uses hexamethyldisiloxane as a solvent and a magnesium-titanium ethylate complex as a deacidifying agent. The titanium component does not contribute to deacidification but optimises the solubility of the magnesium ethylate in the fluorine- and chlorine-free solvent.

In 2000, the papersave swiss facility commenced operations on the premises of Nitrochemie Wimmis AG (NCW) in Wimmis near Thun (Figures 1 and 2). The NL completely deacidified the designated holdings between 2000 and 2014 while the Federal Archives ended the deacidification process ahead of schedule in 2014, as digital transformation had become the primary goal in the meantime. The papersave swiss facility at the Wimmis site is already history; it was closed in mid-2022 as Swiss customers deacidified regularly but in quantities that were too small to continue operating the plant in the long term.

1 Baty et al. 2010.

2 Blüher and Vogelsanger 2001.



Fig. 1: The papersave swiss facility in Wimmis on the premises of the Nitrochemie Wimmis AG, in operation from 2000 to 2022. Interior of the papersave swiss facility. The treatment chambers. Photo: Nitrochemie Wimmis AG



Fig. 2: The reconditioning chambers. Photo: Nitrochemie Wimmis AG

3 Objectives and Priorities of Mass Deacidification

The aim of mass deacidification is to preserve the original substance in its original appearance and thus maintain usability. Chemically speaking, the acids in the paper are neutralised by the alkaline deacidifying agent, an excess of which is stored in the paper as an alkaline reserve. The acid-catalysed degradation of the cellulose, which is responsible for the loss of paper stability, is thus prevented altogether or else slowed down. The papersave swiss process has a proven slowdown of a factor 4 at least.³

Mass deacidification is a preventive measure and what it cannot do is improve paper stability as broken cellulose chains are not ‘patched up’. To date there has been no effective and significant paper stabilisation by way of a non-aqueous bulk process and without drastic undesirable changes to the paper for bound cultural artefacts.

When it comes to setting priorities the approaches of individual institutions differ widely. If the manifest damage is decisive then the casualties shouting loudest are prioritised, namely extremely browned or already brittle papers. From a scientific point of view, however, mass deacidification reaches its limits with these heavily degraded papers for the following reasons:

- They are often not only affected by acid-catalysed degradation but have also become brittle due to oxidative degradation. As a result, they lack the necessary capacity to absorb the deacidification solution.
- They are filled with degradation products that are not removed during deacidification but are brought into an alkaline environment which can lead to browning and other unfavourable changes.
- Deacidification, combined with the incorporation of an alkaline reserve, has the effect of increasing the filler content which can be problematic with papers that have been mechanically severely weakened.

These restrictions apply to the papersave swiss process as well as to all non-aqueous liquid phase processes. Fine dust or particle processes are just as unsuitable for heavily degraded papers, even if the reasons here lie in the lack of mechanical resilience of the documents. Against this background, mass deacidification of such holdings is not the first priority but its justification must be examined and weighed up in each individual case.

³ Andres et al. 2008; Ramin et al. 2009.

4 The Priorities and Approach of the Swiss National Library

The aim of the NL was to treat its core holdings, i. e. all Helvetica in need of deacidification. To this end, a list of priorities was drawn up.⁴ The long-term cooperation with the same deacidification company made it possible to plan and carry out systematically the deacidification according to priorities. The NL prioritised deacidification as described in Table 1:

Priority 0: No deacidification, which includes papers without browning or rag paper.

Priority 3: Preventive treatment, recommended in 10–20 years; the paper is beginning to show signs of browning.

Priority 2: Preventive treatment, recommended in 5–10 years; the paper shows slight signs of browning.

Priority 1: Preventive treatment, urgent; the paper shows clear signs of paper degradation.

Subcategory 1+: Treatment very urgent, bordering on the ‘too late’ category.

Very heavily browned, brittle paper is also not deacidified (‘too late’). For technical reasons holdings with extremely high preparation effort and complex individual selection were only deacidified at the end, regardless of their state of preservation.

⁴ In the period from November 2001 to April 2002, all of the NL’s holding units (excluding the Swiss Literary Archives and the Prints and Drawings Collection) were examined and a list of priorities was drawn up. This inspection did not constitute an actual survey or condition report, as no sample number was defined and the shelf marks of individual samples were not documented. The purpose of the inspection was to categorise the conservation priorities and estimate the amount of deacidification and the necessary preparation time for the individual holding units. The order of deacidification was determined based on this.

Tab. 1: Categories of priority for mass deacidification in the NL.

Paper browning	Usability	Priorities mass deacidification	SurveNIR condition category
none	unrestricted	0 no mass deacidification	1 = good
head cut, edges: beginning; type area: none	unrestricted	3 low (in 10–20 years)	2 = fair
head cut, edges: slightly; type area: barely to slightly	unrestricted	2 recommended in 5–10 years	2 = fair
head cut, edges: clearly; type area: slightly to clearly	barely restricted	1 urgent	3 = poor
head cut, edges: strong; type area: clearly to strong	slightly restricted	1+ very urgent/borderline	3 = poor
head cut, edges: very strong; type area: strong	strongly restricted/ fragile	X too late	4 = critical

According to the initial planning mass deacidification was to be carried out generously, with minimal or no selection at all. As a measure of stabilising conservation, however, it is an irreversible intervention in the original substance; the principles of restoration conservation should not be suspended but adhered to as far as possible. This means no unnecessary deacidification of neutral or alkaline papers, no questionable deacidification of brittle papers and the minimisation of side effects by eliminating risk material.

In practice, this has led to a paradigm shift which has resulted in more and more resources being used in the selection process and fewer items being designated for treatment in the papersave swiss facility. The time required for the entire deacidification process was originally estimated to be 30 years but was actually reduced to 15 years.

Setting priorities and selection are easy to define in theory but not easy to implement in practice. Priorities can only be set at collection level, not at the level of individual documents; the list of priorities described above therefore refers to subcollections.⁵ The NL has over 50 historically evolved subcollections which differ according to subject, format (octavo, quarto, folio, etc.), age, publication form (monograph, periodical, book, pamphlet), etc.

⁵ Called 'shelf mark' [Signaturen] in the NL.

During the ‘selection’ step those documents in the respective subcollection that were not to be deacidified in accordance with the above conservation principles were excluded as completely as possible. As there is no simple and easily accessible technical procedure for this the decision to ‘deacidify’ or ‘not deacidify’ always has a subjective dimension.⁶ The exclusion of rag paper is clearly possible but the demarcation of the transition from acidic to neutral and alkaline paper production is more complex; the threshold is generally between 1980 and 1995⁷ although lower-quality fibres such as recycled paper push the limit back, possibly to the year 2000. It is difficult if not impossible to recognise and exclude heavily degraded and brittle paper reliably without destructive testing; in addition to broken edges an important indication is heavy browning which, however, is not always present. Strong browning, i. e. an L^* value below 80 in the CIELAB colour space, combined with a corresponding paper feel and a document age of at least 50 years, definitely indicates brittle paper. With this visual and haptic evaluation the majority of these papers can at least be recognised and excluded. If in a subcollection their proportion was too high (more than approximately 50%), the risk was too high despite sorting and the entire subcollection was not deacidified.

Even though the NL prefers to speak of ‘paper deacidification’ against the background of the targeted selection it has in fact carried out real mass deacidification; on average, a batch of 1,600 documents was deacidified per week. In total, the quantity of documents deacidified during the period 2000–2014 amounts to 1.18 million documents with a total weight of 483 tonnes. Figure 3 provides a graphic overview of the deacidified and non-deacidified documents as of 2014 at the end of mass deacidification out of total holdings of 3.8 million documents⁸ in the General Collection at that time.

Some 31% of the documents of the total holdings were deacidified, 5% were removed as risk material and not deacidified and 2% were removed due to visible

6 The SurveNIR device should be mentioned here, which was developed for this purpose, among others (Strlič et al. 2008; Rohde and Lichtblau 2013). It was only available in the NL since 2014, after a phase of further development. Its use is limited insofar as the time required for consistent measuring is too high (Kunze 2016).

7 Only papers with a surface pH below approx. 5.5 are categorised as requiring deacidification. According to some authors, deacidification is only really necessary at a pH value below 4.8. The classification with the Abbey pH pen indicates an excessive need for deacidification, as the colour change from violet (‘alkaline’) to yellow (‘acidic’) occurs on paper at a surface pH of 6.3 to 6.4 according to our own observations.

8 Excluding music, prints and drawings, photographs, other data carriers, digital collections. Source: Annual Report of the Swiss National Library 2014, Appendix.

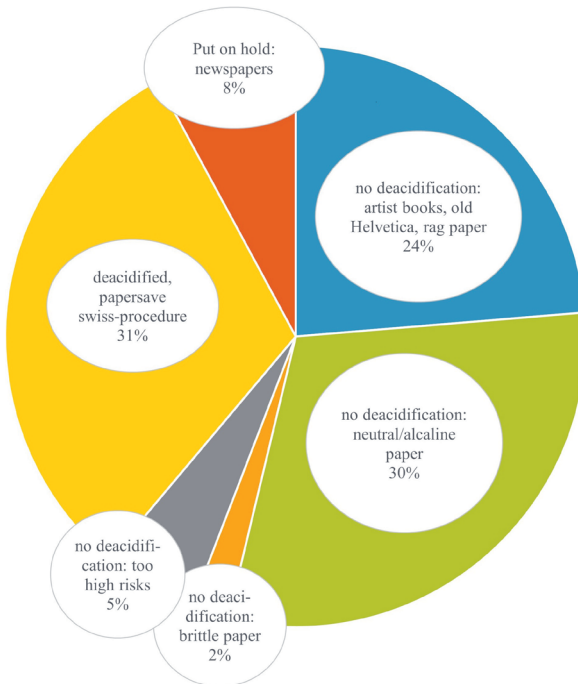


Fig. 3: Deacidified and not-deacidified holdings of the Swiss National Library in percent (General Collection, status 2014, without musical, prints and drawings, photographic and digital collections). Exact statistics were not kept for all categories of non-deacidified parts of the collection; in this case, the figures were estimated. Image: Swiss National Library

brittleness of the paper and not being deacidified. A total of 30% of the documents did not require deacidification as the paper was not acidic and 24% were deferred for technical reasons due to the material; the newspaper holdings of around 8% of the total holdings were also not deacidified. At the same time as mass deacidification, a large microfilming programme was launched for the newspapers in 1999 which was scaled back since 2014 in favour of digitisation and halted altogether in 2018. From a conservation point of view deacidification would be a sensible and necessary measure for some of the newspapers but for financial reasons this is not currently under discussion.

5 Quality Control

Quality control was an essential component of the selection and implementation of the papersave swiss process in the 1990s. The 'Quality Standards for the papersave swiss Process used for the Deacidification of the Collections of the Swiss Federal Archives and the Swiss Federal Office of Culture – Swiss National Library' of 2004 define physico-chemical and optical-haptic quality criteria and corresponding

target or limit values⁹ with details on the implementation found in the literature.¹⁰ The integration of quality standards in the contract for carrying out deacidification is crucial. As the deacidification company is liable for compliance this has a preventive effect; the contractual partners carry out regular checks, inform each other of any problems that are expected or have arisen and share their experiences. On average, over the 15 years of deacidification, 98% of the physico-chemical target and limit values for the NL's holdings have been achieved.

Every mass deacidification process has its own particular and unavoidable side effects. With the papersave swiss process there are no deposits of the deacidifying substance on the paper, as the treatment solution is a true solution. It even penetrates thick books and archive boxes completely and can dissolve certain dyes in the process. The phenomenon of bleeding is therefore a consequence of the in-depth effectiveness of the process; it cannot always be prevented and its occurrence in mild form is tolerated in 1.5–2% of documents. The quality standards were rigorously applied so that in one case a subcollection from the post-war period was not deacidified because the percentage of documents affected by bleeding was too high.

6 Long-Term Monitoring

Mass deacidification is a measure with a long-term effect. The quality assurance of the NL is designed in such a way that the success of the treatment can also be monitored over the long term. Long-term monitoring basically serves several purposes:

1. Monitoring the condition of the deacidified holdings in the NL: knowledge of the condition and its progression is important for future decisions regarding conservation measures or restrictions on use.
2. Expansion of knowledge about the sustainability of mass deacidification depending on the initial state of the documents.

The long-term control is carried out on original documents as well as on three test papers. As the information value of the test papers is very limited compared with the many different original papers they are not included in the following analyses. The original documents examined as random samples were routinely returned to the stacks after deacidification and initial examination and they can easily be retrieved via their shelfmark. A total of 335 samples were measured which cor-

⁹ Swiss National Library 2004.

¹⁰ Andres et al. 2008; Blüher 2012.

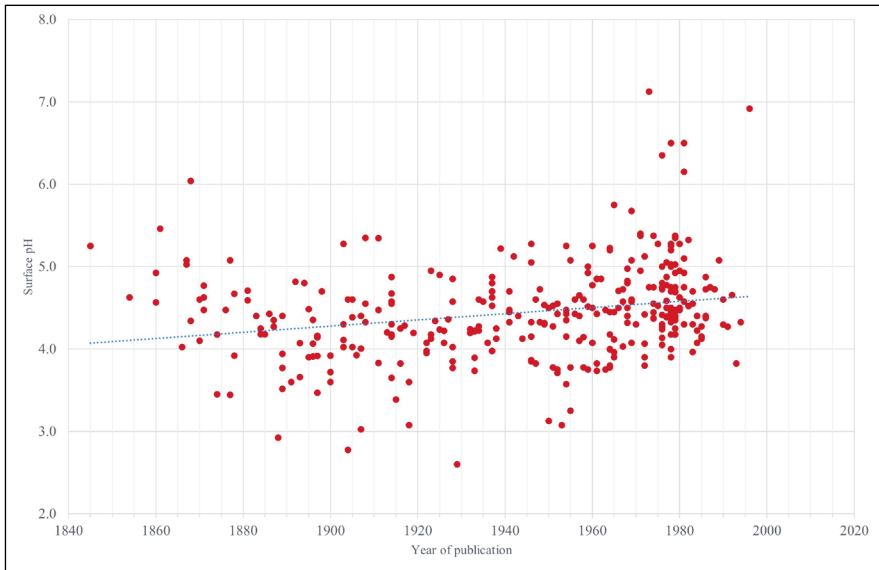


Fig. 4: Surface pH versus publication date of the 335 originals before deacidification. Image: Swiss National Library

responds to 0.03% of the deacidified documents; these were taken from the treatment years 2001–2014 with an average of 24 samples per year, a cross-section of all formats, treatment variants and materials selected at random. The remeasurement interval was five years and may in the future be extended to 10 years or longer.

Long-term monitoring of the NL includes remeasurements of the surface pH and the $L^*a^*b^*$ colour values, which can be carried out in a non-destructive way. The measured values are stored in the electronic archive and, if possible, in the Helveticat library catalogue, MARC field 583.¹¹ The deacidification record in Helveticat contains the item number, the treatment batch and the analysis values of the treatment intensity, the homogeneity, the $L^*a^*b^*$ colour measurement and the surface pH. The colour values and the surface pH are recorded for the remeasurement.

Figure 4 shows the surface pH of the 335 random samples before treatment versus the year of publication. The average value for the years 1845 to 1996 is pH 4.4. Four of the samples have an extremely low pH of 3 or less while ten samples (3%) have a pH above 5.5 and therefore would not have required deacidification.

11 Proof of deacidification in Helveticat can only be added to documents that are catalogued individually and not as batches.

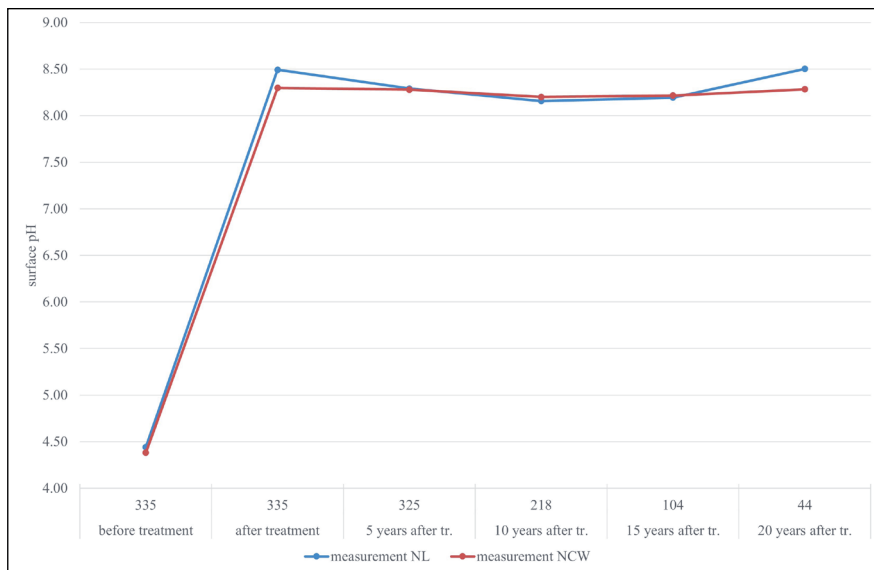


Fig. 5: Surface pH, average of the 335 random samples, before and after deacidification. 20 years after deacidification, a total of 44 samples was remeasured by 2021 (treatment in 2001) and 2022 (treatment in 2002). Image: Swiss National Library

Figure 5 shows the surface pH as the average value of all 335 random samples before treatment (pH 4.4), immediately after treatment (pH 8.4, average NL-NCW, 670 values) and after 5, 10, 15 and 20 years. The measurement of the surface pH is subject to large fluctuations, mainly due to the inhomogeneous composition of the aged paper surface; therefore, a large number of random samples and a long observation period are needed in order to make well-founded statements. The measurements were taken by the NL and by the Nitrochemie Wimmis AG (NCW) company in the same book, with two measuring points on each book page but in different places and on different book pages.

On the basis of several thousand data points it is possible to state with certainty that the surface pH is stable and that the minimum decrease after 20 years lies within the measurement accuracy of the method.

Figure 6 shows the colour values $L^*a^*b^*$ in the CIELAB colour space in the same way as the average values of all 335 random samples. The colour value is only measured by NCW; as it shows but minimal changes it will not be measured regularly in future.

Figure 7 shows examples of various subcollections where deacidification was more or less successful.

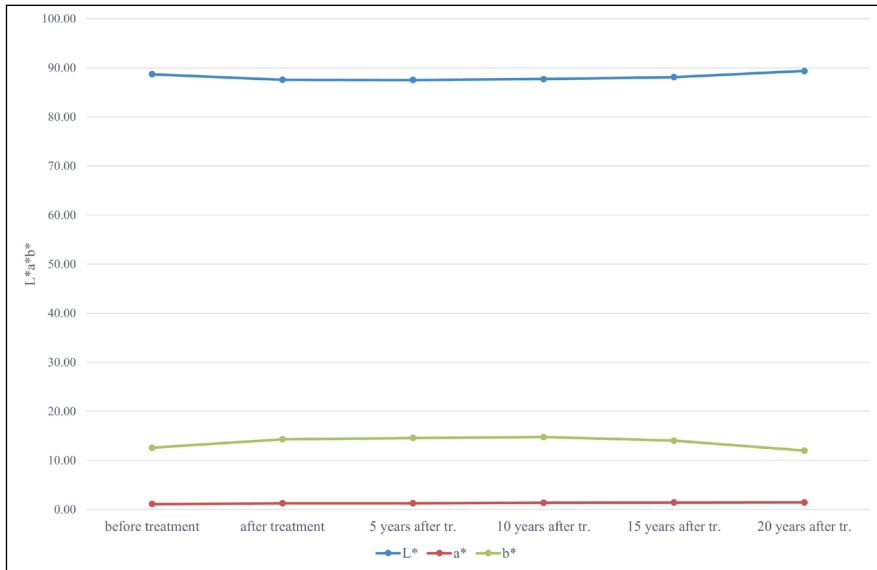


Fig. 6: Colour values in the chromatic field $L^*a^*b^*$, average of the 335 samples, before and after deacidification. Image: Swiss National Library

The subcollection in Figure 7a with around 56,000 books from the years 1900–1930 was deacidified in 2004. The holdings contained strongly acidic and heavily browned papers that were not deselected at the time. The mean value of the surface pH of the 25 samples before deacidification was 4.1 while immediately after deacidification it was 8.0, decreasing markedly over time.

Two papers were previously extremely acidic and browned as well as heavily degraded by oxidation. Over time their surface pH dropped significantly to values below 5.5 which means that their alkaline reserve is already depleted as a result of post-acidification. As a consequence of this observation, such papers, as far as being visually recognisable, were later deselected.

In 2012, in collaboration with NCW, various attempts were made to improve the alkali absorption of such severely damaged papers: soaking the treatment material twice in the treatment solution, with or without interim drying, and increasing the treatment concentration. The trials did not produce the desired results and the effect of a later complete repetition of deacidification of such papers was not investigated.

The subcollection in Figure 7b with approximately 10,000 documents from the years 1890–1980 was deacidified in 2010. The subcollection also contained strongly acidic and heavily browned papers but these, as far as discernible, were deselected. The mean value of the surface pH of the 25 random samples before deacidification

Fig. 7: Deacidification of subcollections in different conditions. Image: Swiss National Library

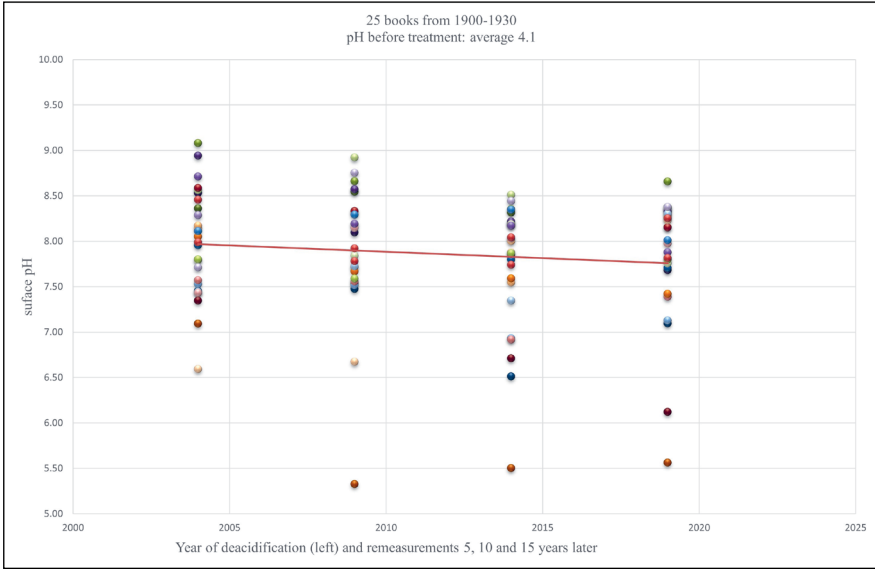


Fig. 7a: Condition 'poor', without deselection of damaged paper: limited sustainability

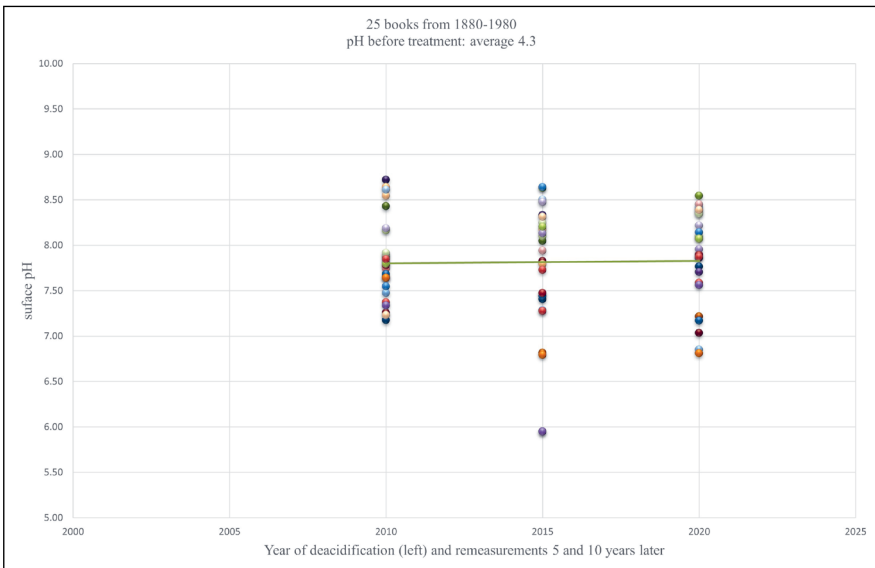


Fig. 7b: Condition 'poor', with deselection of damaged paper: fair sustainability

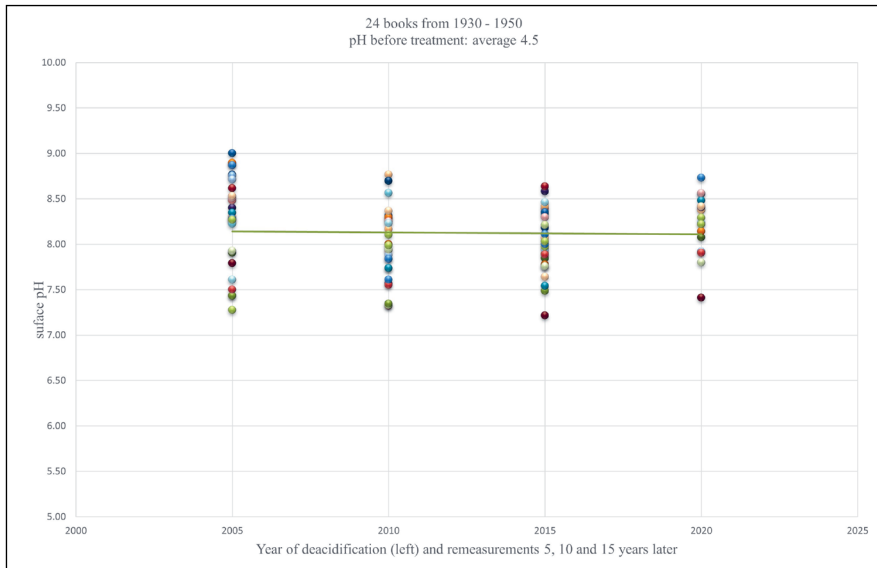


Fig. 7c: Condition 'fair', no deselection: high sustainability

was 4.3 while immediately after deacidification it was 7.8, i. e. at a relatively low but stable level.

Figure 7c shows subcollections with approximately 25,000 documents from the years 1930–1950 with papers in predominantly fair condition. The surface pH was previously 4.5 while immediately after deacidification in 2005 it was 8.3, also at a stable level. This places them in the area of optimal prevention.

A summary of the conclusions from the long-term control after 20 years shows that the surface pH is stable, indicating an intact alkaline reserve. Likewise, the $L^*a^*b^*$ colour values are stable. There are exceptions for around 3% of the documents based on the results of 218 random samples after 15 years. Affected are strongly acidic documents for which the sustainability of deacidification has not yet been proven. Overall, the condition of the deacidified holdings is stable and side effects such as the bleeding of red dyes are only noticeable in individual cases. Digitisation of deacidified documents is also possible without any problems, as there are no powdery deposits on the paper.

The determination of the surface pH is the only method that can be applied to originals on a large scale in a mostly non-destructive manner but it is subject to various uncertainties.¹² An examination of the strength and flexibility of the paper,

¹² Ahn et al. 2011.

the alkaline reserve and the cellulose fibre at molecular level complete the picture. Available for this purpose is the ‘reference books’ data set, which was analysed and deacidified in 2009 and which consists of 18 book sets, of which one book – or one half of a book – is untreated in each case; these complex analyses are to be repeated at longer intervals. In addition, the papers and books are assessed from a restoration perspective with a view to their behaviour during restoration work.

7 Summary

The mass deacidification project is an important investment by the NL in the preservation of its collections. Founded in 1895, the NL is a relatively young institution; its collecting mission began in 1848, the year the federal state was founded. As a result, a large part of its collections falls into the critical period of ‘acidic’ paper production.¹³ The NL carried out the mass deacidification project during the years 2000–2014, i. e. in half the time originally planned, as greater emphasis was placed on selection.

The NL continues mass deacidification, albeit on a smaller scale. This applies to new acquisitions published between 1840 and 1985 that through donations or individual purchases are integrated into collections that have already been deacidified.

As part of long-term monitoring, the NL observes and analyses its collections in order to anticipate the future requirements of the deacidified and non-deacidified parts of the collection. The data collected is a building block for later decisions regarding the preservation of the collections.

The mass deacidification processes were evaluated from the outset with the help of assumptions, in particular with the help of test papers that were analysed after deacidification and after artificially accelerated ageing. Several studies confirm the effectiveness of deacidification and the suitability of accelerated ageing in comparison with natural ageing but they are only based on a small database. With the larger database available in the NL it is possible to monitor comprehensively the sustainability of mass deacidification during natural ageing. In view of the amount of data, the rhythm and intensity of the control measurements must be optimised in order to obtain the critical information with minimal effort. It will be interesting to see to what extent the initial assumptions are confirmed or refuted.

¹³ Grossenbacher 2006.

8 Outlook

What is the future of mass deacidification? This question arises now that several large memory institutions have discontinued or reduced their deacidification activities, while other large institutions still do not carry out deacidification. This is due to a lack of resources as well as a lack of knowledge or interest. In many cases ethical considerations are decisive; mass deacidification changes the documents, even if no visible side effects are observed and the desired goal is achieved, namely a significant extension of the life span and usability. The legitimate concern about undesirable side effects which only later become disturbingly apparent may play a subliminal role. The alternative chosen is storage either at low temperatures or with a low oxygen level in order to avoid any risk. Against this background the control of deacidification processes in accordance with the applicable standards, transparent communication and, last but not least, transparent long-term monitoring take on a new importance. This is because the various processes of mass deacidification differ greatly in their area of application, their effectiveness and their side effects. Both advantages and disadvantages should be discussed more openly because secrecy is counterproductive to the preservation of our cultural heritage and the future of mass deacidification.

In the NL, at any rate, the beacon of mass deacidification still shines even if in the digital age it has gained quite a bit of competition.

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Marie Vest

Preservation at the Royal Danish Library – Achievements and Future Perspectives

Abstract: The Royal Danish Library is Denmark's national library. It serves as the library for several Danish universities and holds the national legal deposit collections as well as significant national cultural heritage collections. Collection care and preservation is a cornerstone in the mission of the Royal Danish Library. Safeguarding the collections calls for a mix of actions including preventive measures, mass treatments and conservation treatments of individual objects to make them accessible and usable for readers. To prioritise actions and resources for preservation it is important to understand the nature, significance and size of the collections. Likewise, it is necessary to survey the collections to obtain information on the chemical and physical composition of the materials, their state of preservation and their storage conditions. Altogether, this knowledge forms the foundation for the library's preservation strategy and day-to-day decision-making. The challenges from growing collections are met with storage in several climate zones designed to preserve different types of vulnerable materials. The library rejected mass deacidification and chose to direct resources into preventive measures while important objects with physical damage still undergo conservation treatment.

This chapter also describes how decisions around collection care have been adapted to changes in the general library strategy and changing internal organisational structures. Furthermore, it puts into perspective how external political priorities and responses to global challenges such as climate change have an impact on the library's preservation decisions and considerations around sustainability in heritage preservation.

Article note: I thank all current and former employees in the preservation department and in the Royal Danish Library for their contribution to the work performed by the preservation department to preserve cultural heritage.

Marie Vest, Royal Danish Library, Copenhagen

1 Introduction

The Royal Danish Library has its roots in Copenhagen University Library, established in 1482, and The Kings Library, founded in 1648 by King Fredrik III. It has a long history of mergers leading to shifts in purpose and collection practices.

At the beginning of the twenty-first century political focus in Denmark was on merging state institutions within the area of museums and libraries, research and educational institutions. In the library sector this fusion happened with the Royal Danish Library as a central focus point. Mergers did not happen in order to make savings in the budget but to strengthen digital developments, give easy access to more library resources and support Danish universities in becoming top ranked in the global context.

Merging libraries with the Royal Danish Library started with the Natural and Medical Science University Library in 2005, The Folklore Archives in 2008, Danish Art Library in 2017 and The State and University Library in 2017. Today the library holds more than 100 shelf kilometres of cultural heritage collections stored in several locations. The main tasks of the library are multifaceted. It serves as the national library, university library for most universities in Denmark and loan centre for Danish public libraries, has research activities and provides cultural activities for the public audience.

This chapter focuses on the library's role as a national library since this part of the organisation is responsible for the care and preservation of all cultural heritage collections including old university library collections. While the library has digital as well as physical collections the aim here is to describe strategic considerations around preservation of physical materials.

A large part of the physical collections stem from legal deposits of publications including books, journals, pamphlets, newspapers, maps and music prints. Another part, the special collections, are collected through donations and acquisitions and include manuscript collections; music and drama collections; Oriental and Judaica collections; maps, prints and photographic collections; folklore archives; and art and architectural collections.

2 From Bookbinder's to Conservation Workshop – A Gradual Change

2.1 Tasks

The Royal Danish Library had its own bookbinders from 1664 when two French bookbinders received an appointment at the King's library. Its main duty was to bind and repair volumes, as binding was the basic measure to make collections robust to wear and tear. With the legal deposit law in 1697 the bookbinders would bind and maintain the publications and special collections materials of unique origin that the library received from printers in Denmark.

However, the bookbinders could not keep up with the industrial developments for new bindings in the private workshops who therefore took over this task in the 1950s. The bookbinders subsequently concentrated on the rebinding and maintenance of the books and materials already stored in the library.

Several bookbinders took part in the rescue action after the catastrophic flood in Florence in 1966 which destroyed many important books and other works of art. This disaster increased awareness of cultural heritage preservation in general and made it clear that the library needed to develop the practical preservation actions to meet the needs in collections. An overall disaster and preservation policy was developed in the 1970s including standards for the practical bookbinding and conservation work and for emergency plans and stacks. Furthermore, the workshop established a wet room for treatment of paper and the first leaf-casting machine in Denmark was introduced.¹ The workshop also changed its name to Binding Section, Preservation and Restoration Workshop to mark this change of responsibilities.

2.2 Skills

In the beginning the staff consisted of bookbinders who took up conservation methods, and new generations had to undergo apprenticeships to learn the conservation craft. The growing understanding of the field of conservation in Denmark led to the founding of the School of Conservation (today Institute of Conservation) as part of the Royal Danish Academy in 1973. Since then, the institution has educated students at the bachelor, master and PhD levels in book, paper and photographic conservation, preparing them for jobs in workplaces such as archives and libraries.

¹ Larsen et al. 1992, 1–47.

This gradually led to a shift in the staff's educational background, as conservators replaced retired bookbinders over a time span of 15 years. Today, the main core of the staff are conservators holding degrees from all academic levels, from bachelor up to senior researcher, with the addition of a few bookbinders.

2.3 Organisation

In the mid-1990s the library made an important strategic decision regarding the development of the conservation work. Instead of being a small bookbinding and conservation section in a multi-sectional department the workshop changed into a preservation department on its own. In 1996, a head of the preservation department was hired, with the professional requirement being an academic conservation degree. Of equal importance was the direct reference of the head of preservation to a deputy director who is also a member of the executive board. This structure supports an acknowledgement of preservation issues at the highest organisational level.

3 Strategic Preservation Planning

3.1 Collection Survey 1999–2001

The professionalisation of the conservation field led the library to initiate a comprehensive survey in 1999–2001 of all cultural heritage collections.

The planning of the survey started in the collection departments with a discussion of the historic significance of each collection. This led to a strong focus on collections of importance for future generations and excluded only collections going on loan outside the secured reading room. The survey design ensured reliable statistical results for each collection in order to have a sound foundation for strategic decision-making around collection care.

This survey² documented an urgent need for conservation efforts and concluded that it required a radical change in the conservation policy. Thus, the conservation work was to include more preventive work and an extensive prioritisation by the collection departments had to be implemented. Conservation had to be reserved for the most valuable objects. A large number of objects were in need of

2 Bevaringsplan 2010, 1–88.

housing and some unstable materials such as brittle paper, cellulose nitrate negatives and acetate negatives were found to be in a highly deteriorated state and in demand of substitution into high quality copies. A greater focus on preventive measures was highly recommended as preventive efforts would benefit all collections. Most storage facilities were of poor quality and an improvement of climate conditions was necessary to preserve the vulnerable materials.

3.2 National Commission – Status of Cultural Heritage Preservation

The library survey made the Ministry of Culture aware of the major challenges with the preservation of cultural heritage in the public collections in Denmark. The persistent work of library director Erland Kolding Nielsen convinced the politicians to arrange a hearing about cultural heritage preservation at the Danish Parliament in 2001.

After the hearing the Ministry of Culture set up a commission of key persons from the cultural heritage field. Their work resulted in a report³ which gave a national overview and a number of recommendations for future actions. The serious lack of good quality storage for cultural heritage collections in almost all institutions was emphasised and the report uncovered the massive need of resources and funding for conservation of objects. Directly related to the libraries and archives was the necessity of action on the large amounts of acidic paper becoming brittle and thus impossible to handle. Furthermore, the urgent need for more storage space in a quality giving long-term preservation to heritage collections was addressed.

3.3 Combining of Conservation and a Preventive Programme

The national report led to multiple national grants given to cultural heritage institutions in 2004 and onwards until today. The library received 95% of the estimated resources needed to bring care for collections up to a reasonable level. This grant enabled the appointment of ten conservators and the department built up detailed expertise in various areas. The scope of preventive work was increased and it became possible to focus on many different areas within the library which included dialogue with other staff groups and a formal set up to ensure progress. A wide range of actions were introduced to support careful handling in every library

3 *Udredning om bevaring af kulturarven* 2003.

process from transport to the user, either internal digitisation or external users in the reading room. A regular inspection of storage areas and other premises with objects only kept there on a temporary basis was strengthened to increase order and cleaning standards. Quality of storage environment and disaster management was in focus because of problematic issues in the buildings. This work had to support an enhanced level in the storage environment, prevent disasters and, if it was to occur, minimise damage. The boxing of library materials has been part of prevention work since 1995, but with a new box machine and a minute review of all processes in box production the production of boxes has increased with a substantial number. Due to more resources it was also possible to standardise the procedures for taking private archival materials into the library. Conservators check for dust and pests, sort and pack the material according to stability and appropriate climate zone in the storage, and collection staff add it to the catalogue. Preventive tasks shifted focus over time and pest management has become a major task in preventive work because of the introduction of new species.

It is important for the preservation department that all preventive work is carried out by professionals who can assess whether a possible threat to an object is critical or can be ignored. Involvement of other staff groups is a necessity since library materials are in a constant flow from storage into use and back to storage. The main core of materials has a standard flow in a library but to secure a special and more protective flow for cultural heritage materials and for the very precious objects it is necessary to keep a constant eye on general library issues which might affect the flow. Working with other professionals in the library should be formalised in working groups meeting on a regular basis, but good informal contact to colleagues can also bring preventive work forward.

A serious concern in exhibiting cultural heritage is preventing a possible fading of the objects and giving the right recommendations for light exposure is of high importance. Exhibitions are an important part of the library's profile and conservators have become an integrated part of the whole process from beginning to end. Mounting of materials improved with a new design⁴ and exhibition areas in the library expanded out of the traditional exhibition areas and into the open public library hall in the library building, known as the so-called Black Diamond. These areas have different light quality and objects to be exhibited have a wide range of light sensitivity. This led to the development of a light mapping of the exhibition areas to enhance the decision-making process during planning of the exhibitions.⁵ The light mapping project also led to establishing a micro fading tester and this

4 Hansen 2019, 117–120.

5 Hansen et al. 2013, 15–24.

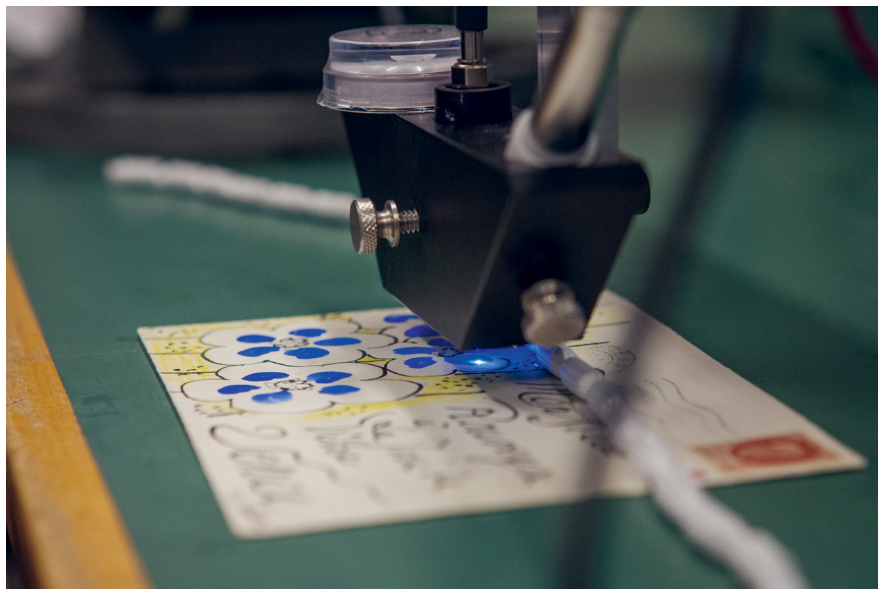


Fig. 1: Micro fading of colours has become standard analysis before exhibiting an object. Photo: Annemette Kuhlmann

analysis is now mandatory before any works are selected for exhibitions (Figure 1). Depending on the light sensitivity of the objects and the prescribed light policy, objects might be rejected for exhibition if the total amount of light exposure cannot be adjusted to the required level. The measured levels of light sensitivity and exhibition exposures are kept in a database for future evaluation and decisions concerning exposure.

4 Preservation of Unstable Library Materials

4.1 Acidic Paper – Cold Storage or Treatment?

A major preservation challenge for the library is the preservation of paper collections, books and archival material from the nineteenth and twentieth century. Following the national recommendations in 2004, a committee for the consideration of mass deacidification as a possible treatment was formed. The library was part of this committee and initiated a survey in the collections to get a proper understanding of the amounts of acid papers and their state of deterioration. The results of the

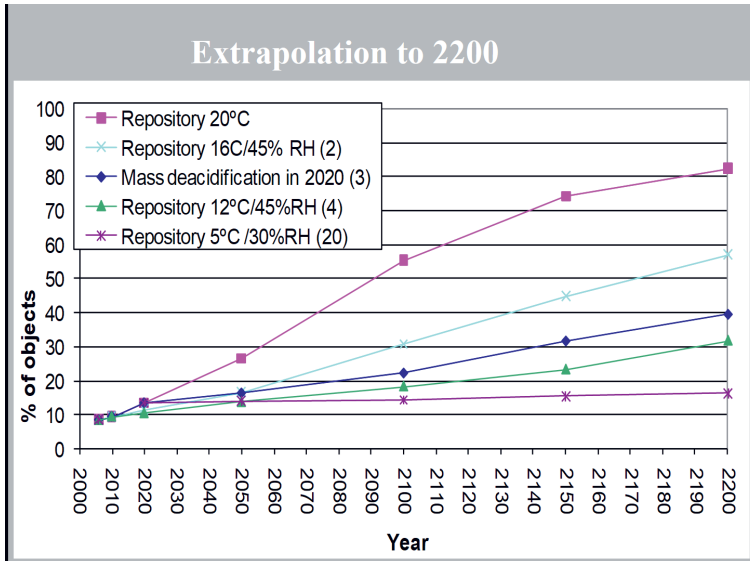


Fig. 2: Lifetime estimations by different means for The Royal Danish Library's collections from 1850–1985. Image: Royal Danish Library

survey showed that in 2006 93% of the paper from 1850–1985 was acidic and that 7% was already brittle and breaking after three hand folds. Lifetime estimation by different means was calculated from the age, pH and brittleness of the examined objects, which showed a great difference in the various measures (Figure 2). A cold environment would effectively slow down the degradation rate so that the number of objects that exceeded breaking after three hand folds would only increase three percent (from 13% to 16%) from 2020 to 2200.

Since preventive conservation is preferred to treatment which often has side effects in the short or long term, the costs of cold storage versus mass deacidification were also calculated. At that time, 2006, it was possible to decrease the temperature to 10°C for 190 years for the price of mass deacidification.

The committee report on mass deacidification⁶ had a clear conclusion for the collections in the Royal Danish Library. Based on a review of the advantages and disadvantages of cold storage and mass deacidification, respectively, the Royal Danish Library took the position that in the future focus would only be on expanding the capacity to store the collections cold as mass deacidification was neither a conser-

⁶ *Bevaring af surt papir i de statslige samlinger* 2008, 1–45.

vation-wise nor economically competitive method compared to cold storage, shown in Figure 2.⁷ The library also concluded that this was in line with the Ministry of Culture's own report on the preservation of cultural heritage from 2003 which recommended that acidic, wood pulp paper should be stored at around 5°C.

5 Library Collection Storage

5.1 Storage Policy

The conclusion of the mass deacidification committee's work stated in 2008 that the library would give priority to cold storage of acid paper and set a clear strategy for the future storage plans. Each type of material, depending on its susceptibility to deterioration, was to have a designated climate zone decreasing the rate of deterioration to the lowest possible level. In practice, this would mean sorting all existing and incoming collections into different climate zones since collections traditionally were kept in order with their topic or provenance.

5.2 Growing Collections and Lack of Storage Space

Throughout the library's history the constant flow of incoming materials has made a lack of space a recurring problem. Although the library built a new facility in 1998 it was still lacking quality storage as emphasised by the national commission in 2003. Therefore, in 2004 the Ministry of Culture approved building a new storage facility where the strategy of climate zones could be implemented. The facility was designed with a cold zone for photographic materials and a cool zone for books.⁸ To keep energy consumption of the mechanical ventilation system as low as possible, the cool book storage has a so-called passive climate curve where the temperature is allowed to fluctuate slowly over the year, having a cool set point during winter (8°C) and a higher temperate set point during summer (16°C). Compared to a fixed set point of 12°C, a slowly fluctuating climate curve over a full year makes it possible to save approximately one third of the energy consumption.

Cellulose nitrate negatives are unstable and spontaneously combustible and therefore require cold storage separated from the rest of the cultural heritage col-

⁷ Hansen 2009, 59–66.

⁸ Vest et al. 2008, 808–814.



Fig. 3: The building site for a new storage facility in Vinge. Photo: DS Flexhal

lections. The Danish Film Institute thus inaugurated a frost storage in 2008 in which the library was able to rent three compartments for storage of the library's nitrate negatives.

It was only with the inauguration of a new large storage facility in February 2022 that the library's space problem was properly addressed (Figures 3 and 4). The new storage located in Vinge in the northern part of Seeland is a common facility for the National Museum of Denmark and the Royal Danish Library. It is the result of long-term work with the preservation of Denmark's cultural heritage, put on the agenda with the report from the commission set by the Ministry of Culture and published in 2003.

5.3 State-of-the-Art Storage Facility – Vinge

The new storage facility in Vinge has two different climate zones, which give most types of material an improved lifespan. The most sensitive and easily degradable materials are stored in a cold climate (3–6°C) and the more stable materials are stored in a cool climate (7–14°C). In the long-term, fewer materials will therefore chemically break down, meaning damage will be prevented instead of the material having to undergo conservation. For already damaged objects it will still be



Fig. 4: The new storage was ready for moving in collections in 2022. Photo: Atle Clausen

necessary to protect them when they are retrieved from the storage. This will be done with protective boxes, gentle transport and handling. For the damaged and in-demand items conservation will still be a solution to take care of the cultural heritage.

The Vinge storage has approximately 116 kilometres of shelf space distributed over two floors, with the ground floor containing the cool climate zone and the first floor the cold climate zone. Before moving the collections to the new facility they were assigned to the most suitable climate zone. The library has tried to keep the collections together as a whole or make a division in climate zones on a large scale. Still, works were divided into four different shelf formats. The relocation project⁹ moving works to the new facility was divided into phases. The first phase started in August 2022 and the second and final phase was completed by the end of 2023. In total the library plans to finish the relocation project and empty the old library building's storage area within three years.

In order to plan the relocation all collections were listed in spreadsheets with format, number of shelf meters and climate zone recommendation included. To come up with a clear plan for the new placement of collections and how they will fill

⁹ Pataro and Petersen 2023, 36–40.

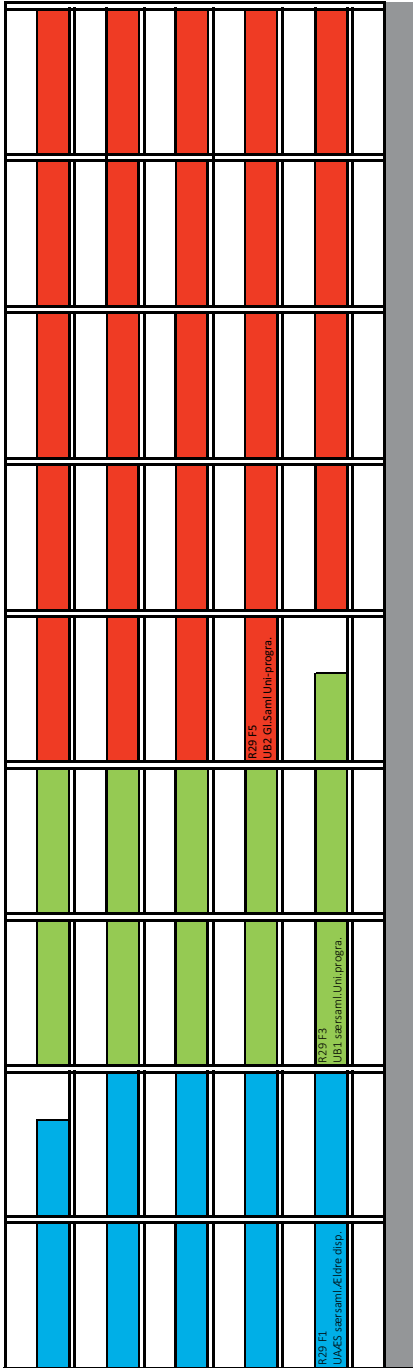


Fig. 5: A visualisation by Revit of nine shelf racks, each with five shelves and each color representing a collection of books. The name of the collection is added at the first shelf. Image: Royal Danish Library

up the new shelves, the library developed an add-in programme for the construction software Revit. Revit holds all building plans of the library and the add-in programme enables the spreadsheet data to be imported into Revit which visualises all collections on the shelves in floor plans seen from above as well as direct view at the shelves (Figure 5). In the drawings it is possible to see how a large number of collections will fill up a whole storage room and to see the actual placement on a specific shelf with the name of each collection. Finally, the placement codes are exported back to the spreadsheet to complete the overview. Being able to foresee collections placement, the number of shelf meters and free shelving space is a major achievement in storage planning for the library. Earlier large moving projects always had an element of uncertainty with regard to this part of the storage planning which has now decreased to a minimum.

The new storage facility meets high security and preservation requirements and at the same time, emphasis was placed on sustainability when both establishing and operating the magazine. Sustainability plays a big role for the library and from the very first initial meetings about a new storage facility emphasis was on low energy consumption without compromising optimal conditions for the cultural heritage. Therefore, the facility is built with extremely dense and heavily insulated facades and roof surfaces. At the same time the stable temperature of the ground is utilised through an uninsulated bottom deck to allow for a cool and slowly fluctuating climate, reflecting the outside temperature. The energy consumption has thereby been minimised to what is necessary for dehumidification and for cooling the cold library storage compartments. To keep this at a minimum geothermal heating is installed.

6 Research and Development

The library's strategic preservation plan and the grant enabled the preservation department to expand the workforce and increase specialisation and knowledge about the conservation of archive and library materials. It also led to a more scientific and analytical approach to preservation and has made it possible for the preservation department to engage in more research and development projects.

The library's research focus has included work on the deterioration and treatment of physical collections¹⁰ and how visual analyses can contribute to biocod-

¹⁰ Rouchon et al. 2013; Hansen and Sørensen 2017; Vila et al. 2021.

icology.¹¹ It has also reached out to cross-disciplinary fields including trustworthy imaging of cultural heritage, costs of digital preservation and application of machine learning tools to support preservation of cultural heritage.¹²

A long-term experiment was set up in 2009 to investigate how different storage conditions and housing materials affect paper degradation. It is yet to be analysed to draw conclusions, which can occur as soon as degradation is measured to be significant.

Further analytical instruments were acquired to increase the understanding of our library materials. Multispectral scanning analysis has become an additional tool and is now based in the digitisation department. It enables an uncovering of information in documentary materials which is hidden to the naked eye. The most recent addition of analytical equipment is a handheld x-ray fluorescence spectrometer. The main purpose of purchasing this equipment will be the identification of toxic elements in our library materials, such as arsenic.

7 A Green Library

In 2019, the Royal Danish Library published its first strategy to become a green library. The vision of the climate strategy is that the library's operations will be climate neutral by 2050. It will focus on reducing CO₂ in the areas of building maintenance and storage facilities, transport and logistics, buying materials and services and waste and recycling.¹³ The Department of Preservation works closely together with the department for building maintenance to reduce CO₂ emission from storage facilities. System shutdowns are also implemented as well as reconsidering climate set points. Solar cells have already been installed on several buildings, and heat pumps and geothermal heating are considered in other cases.

The remaining focus points in the strategy will also affect how conservators make the collections last longer. As the largest purchaser of paper and cardboard, the preservation department will have to include quality requirements based on life cycle assessments. Some of the products used for packaging of collections have a large climate footprint and this issue will be addressed in the coming years.

11 Fiddymment et al. 2019; Vnoucek et al. 2020b; Vnoucek et al. 2020b.

12 Wüller and Kejsler 2016; Kejsler et al. 2011; Gindley et al. 2014; Kejsler et al. 2021; Boesgaard et al. 2022.

13 *A Greener Library* 2021.

8 Conclusions and Future Perspectives

With a clear conservation strategy set more than 20 years ago and with financial means to support it, the Royal Danish Library has succeeded in transforming a conservation workshop with roots in the traditional bookbinding craft into a modern preservation and conservation department. With the strengthening of preventive conservation methods and involvement across the organisation we have positioned the preservation department as an integral part of the library rather than being a service that can be ordered according to what others think is necessary.

The conservation experts have been involved in large building and relocation projects in recent years, making valuable contributions, and at the same time have been able to make the necessary compromises without selling out on important preservation principles.

Good storage conditions and materials assigned to the most suitable climate zone will delay the chemical degradation of materials. However, the library reader's constant need for physical materials requires a constant effort to prevent physical damage and to conserve objects which suffer from damage. Still, physical exhibitions are an important part of the library's profile and conservators' expertise is needed to ensure what would have otherwise faded in three months can be stored unaffected in storage for decades. Research and developments in the understanding of materials are essential to support all aspects of a conservator's work and form the future ways of interpreting our cultural heritage with respect to preservation.

Climate change and other changes in library strategy will influence conservators' way of decision-making in the future and challenge traditional ways of working. However, conservators are trained to think about long-term stability in our work and sustainability should therefore be an obvious parameter to incorporate in our work.

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III Digital Strategies: Opportunities and Synergies

Ulrich Fischer

Digital Reconstruction of the Cologne Fragments – How, with the Help of AI, ‘Cologne Flakes’ Are Turned Back into Complete Items

Abstract: After the devastating collapse of the Cologne City Archives in 2009 approximately 95% of the archival holdings were salvaged – with much of the material largely intact but some of it highly fragmented. During the process of reviewing these items (‘salvage capture’), which will soon be concluded, millions of ‘puzzle pieces’ have been recovered from all types of holdings. As with all salvaged archival material these fragments are intended to be restored so as to render them usable again in the medium to long term. However, manually reassembling these fragments which are soiled, completely jumbled and mechanically damaged is out of the question. Furthermore, the available staff need to focus their conservational and archival resources on working with the archival material that survived intact. For these reasons a separate workflow was identified for processing the fragmented archival holdings. At the recommendation of the Fraunhofer Institute for Production Systems and Design Technology (IPK), the Historical Archive of the City of Cologne cooperated with its partner MusterFabrik Berlin to develop a technological solution and carry out the appropriate procedures to reassemble these so-called ‘Cologne flakes’, virtually at first. Since 2020, the ‘Digital Reconstruction of Fragments from Cologne’ project has been under way on a massive scale. In combination with the employees’ specialist skills and knowledge of the holdings the Historical Archive of the City of Cologne has found the deployment of artificial intelligence to be an important tool for reconstructing even these severely damaged archival materials.

Article note: This contribution was produced together with Bettina Schmidt-Czaia, Wolfgang Meyer and Hanna Kannengießer. It is a slightly revised and updated version of the text of the oral presentation, reflecting the status of the reconstruction work on the Cologne City Archive at the end of 2022.

Ulrich Fischer, Historical Archive of the City of Cologne, Cologne

It is undisputed that the collapse of the Cologne City Archive in March 2009 was a decisive date for the handling of written cultural heritage.¹ The impressions created by the destroyed building and also of the joint salvage and immediate rescue efforts acted as a catalyst to accelerate the already existing tendencies towards a comprehensive understanding of preservation and conservation.² The focus in conservation shifted from individual items to entire holdings and collections; concepts for the cleaning and packaging of large quantities of archival material, overarching digitisation efforts and cooperation between institutions in preservation and emergency prevention became the focus of professional discussions – and consequently are among the funding priorities of the Coordination Office for the Preservation of Written Cultural Heritage (KEK).³

Of course, all these aspects play a role in the reconstruction of the Historical Archive of the City of Cologne.⁴ The innovations in the field of reconstruction that have shaped the work include the packaging strategy based on the newly-developed Rhenish archive box [‘Rheinischer Karton’]⁵ quantity processes for dry and wet cleaning, the extensive employment of assistants in restoration and the registration of salvaged items, barcode-based logistics including dynamic instead of inventory-based storage and, finally, the digitisation of processes that allow the work of archivists and conservators to be controlled and documented seamlessly in an additional module to the archive database.

Much of what was developed and introduced for the reconstruction work at the Cologne City Archive in the first decade after its collapse is currently being adapted to the conditions in our new building at Eifelwall. Here the focus is on the

1 In the Coordination Office for the Preservation of Written Cultural Heritage's (KEK) first publication, for example, the collapse of the Cologne City Archive is cited on the first three pages (in the introductory words of the then Federal Government Commissioner for Culture and the Media (BKM), Bernd Neumann, the then Chairwoman of the Cultural Foundation of the German Federal States, Isabel Pfeiffer-Poensgen and in the body text itself) as the driving force for the creation of this institution and the search for national strategies for the preservation of written cultural heritage, see <<https://www.kek-spk.de/publikationen#anf%C3%A4nge-der-kek>> (last accessed 18 October 2023).

2 Thus as early as 2009 in the position paper *Zukunft bewahren* by the Alliance for the Preservation of the Written Cultural Heritage, see <<https://www.kek-spk.de/publikationen#mehrsprachige-ver%C3%B6ffentlichungen>>, 7 f. regarding the archives (last accessed 18 October 2023).

3 See <<https://www.kek-spk.de/foerderung>> for various examples of the aforementioned funding priorities (last accessed 18 October 2023).

4 See Fischer and Späinghaus 2019 for further literature.

5 The Rhenish archive box is a slip-lid cardboard box of folio format and a height of 12 cm, which serves as the basis for a packaging system to which the shelf dimensions in the new building at Eifelwall have been customised.

consolidation of procedures as part of a general process management as the size of the task and the diversity of the individual measures required for success necessitate intensive coordination, the definition of processes, knowledge management and above all coordination at the interfaces of the organisational units involved. All procedures that are adapted or newly developed must be orientated towards the main objectives. In this context the emphasis is on making archive material available for use.

For the greater part of the approximately 95% of our archive material recovered between 2009 and 2011 we have procedures in place to achieve usability – digital or analogue, with more or less lead time. This is the case for all those archival objects that were salvaged (largely) intact and which could be made retrievable by reconnecting them to an entry in the digital finding aids during one of the various phases of registration. In addition, salvaged archival units that could not be linked to the digital finding aids can be retrieved as they were described in the registration process.⁶

But what happens to the rest, to the fragments? Here we distinguish between the ‘formation fragments’ and the ‘puzzle fragments’. The former are individual pages or salvaged archival units with several pages but which no longer form a complete archival item and whose allocation to cataloguing units remains a major challenge. Much more problematic still, however, were and are the so-called ‘puzzle fragments’, i. e. parts of pages that our careful salvage and sorting teams were able to recover from the rubble. For these, the first responders coined the somewhat offhand term ‘Cologne flakes’, and they collected them by the boxful (Figure 1).⁷

In addition to smaller quantities of fragments in normal recovery boxes, entire groups of fragments were collected in specially created boxes when all the recovered items were recorded. In total, several million puzzle fragments were salvaged after the collapse.⁸

This amount of fragmentation of our archive material is not surprising; in many cases, it was the enormous shearing forces that destroyed entire files in the course of the collapse. Additional fragmentation resulted from the exposure of archival materials to water, in some cases for months, and also from security and evidence preservation measures on-site, in particular drilling and other measures to explore the subsoil at the site of the collapse. Considering the extent of the destruction it

6 More than half of the estimated 1.5 million salvaged items can be found and ordered for use, allowing for an appropriate lead time for their conservation and archival processing.

7 This term first appears in a report by Dietmar Bartz for the *taz*, see Bartz 2009.

8 It is still not possible to determine the exact number, as the fragments were collected but not counted in the processes to date.



Fig. 1: Fragments from the Historical Archive of the City of Cologne. Photo: City of Cologne

is actually astonishing how many archival materials of all types survived the collapse intact. Essentially, the fragmentation affects all holdings that were stored in the collapsed storage rooms. The respective extent results from various externally specified variables. The storage location of the holdings or parts of the holdings in the collapsed storerooms play a role, as do the type and quality of the archival packaging, the materiality of the objects and the salvage location from where the objects were salvaged.

Assembling the fragments (puzzle fragments as well as formation fragments) is a special task in the context of reconstruction. They are the weakest link in the reconstruction process so to speak, as the restoration and archival challenges are particularly concentrated in the small, torn objects. In other words, reassembling an indexed archival item that has been broken into puzzle fragments to make it usable again in its original form demands many times the effort required for physically intact salvaged indexed archival items. Therefore, the question is: why does the Historical Archive deal with these particularly problematic cases – and how can the fragmented items best be reprocessed?

The question of why is clearly answered by the North Rhine-Westphalia Archive Act: paragraph 2 section 7 stipulates that ‘archive material [...] shall be preserved

[and] maintained [...]'.⁹ There is no doubt that the fragments created by the collapse are archival material as they had previously been checked for their archival value by an archivist and subsequently transferred to the holdings of the Cologne City Archive;¹⁰ Hartmut Weber, the former president of the Federal Archives, includes the reassembly of the fragments in his expert report for the Cologne Regional Court and reckons that there are easily three million of them. However, not all of the 'Cologne flakes' are fragmented archive material. The puzzle fragments include fragments from the library and material from the archivists' offices and neighbouring buildings. In many cases, however, a distinction between these categories cannot be made on a puzzle fragment alone and thus, in case of doubt, the puzzle fragments found are further processed together.

While the overwhelming majority of the archive material affected by the collapse is owned by the city it is well known that some of the bequests and collections are permanent loans. The Archives Act and its relevant regulations on the preservation and restoration of documents worthy of archiving also apply directly to these holdings; this means that even if the fragments from these holdings could be reliably distinguished from other archive materials the obligation to process them further applies analogously to them as to records of municipal provenance.

In addition, not only the City of Cologne but also the owners of such permanent loans have claims against those responsible for the collapse of the archive. This means that mitigation and preservation measures must be applied equally to all the material, whether municipal property or permanent loans, whether fragmented or intact. This is understandable as the decision in favour of the inclusion of succession property in the archive – be it as a permanent loan or with a later transfer of ownership to the City of Cologne – was and is made for the same reasons as for municipal administrative records; the aim is to secure unique, archive-worthy heritage for posterity.

In view of limited personnel resources, however, it is an important goal to process the 'Cologne flakes' manually as seldom as possible as the available capacities can be used more efficiently for restoring unfragmented archive material. However, if the preservation, identification and assembly of fragments from the collapse are essential from a legal point of view but at the same time the personnel, logistics and space required for this 'conventional' processing are not available, the only remaining option is the development and introduction of technical procedures for the processing of the fragments. The Cologne City Archive has followed these

⁹ <https://recht.nrw.de/lmi/owa/br_bes_detail?sg=0&menu=0&bes_id=13924&anw_nr=2&aufgeho-ben=N&det_id=320558> (last accessed 18 October 2023).

¹⁰ For the following, see Fischer 2015.

guidelines in the development of its ‘Digital Reconstruction of Cologne Fragments’ project.¹¹

Very soon after the collapse contact was made with the Fraunhofer Institute for Production and Design Technology (IPK) in Berlin. Members of the Bundestag from Cologne were among those who recalled that this Institute, with its ‘puzzle software’ for the ‘Stasi snippets’ [‘Stasi-Schnipsel’], had a technology that also seemed suitable for the Cologne fragments.¹² In April 2009, Bertram Nickolay, the head of the department responsible at Fraunhofer IPK, came to Cologne with a number of employees on a first visit – and it was not to be their last, as it quickly became apparent that the expertise developed by the ‘Machine Vision’ [‘Maschinelles Sehen’] department at Fraunhofer IPK could also be used for the Cologne fragments.¹³ A feasibility study completed in 2010 identified good opportunities for the digital reconstruction of the ca. three million Cologne fragments. However, it pointed out that, unlike in the case of the destroyed Stasi files, it would be impossible to subdivide the total quantity of snippets into self-contained units (which, in the case of the Stasi records authority, were bags) and that conservation treatment including cleaning would be necessary prior to scanning.

The Historical Archive’s cooperation partner in the development of a system for the digital reconstruction of the fragments was MusterFabrik Berlin, a partner company of the Fraunhofer IPK which further develops the existing technology, adapts it to the respective areas of application and was able to help develop work aspects in the area of pure ‘Machine Vision’. In 2012, the MusterFabrik was commissioned with a research and development project to demonstrate the technical feasibility of a ‘restoration assistance system’ in the form of a prototype for the digital and physical restoration of the damaged archive materials of the Historical Archive of the City of Cologne. This was a multi-year project that involved more than just developing software and defining and adapting parameters for the virtual reconstruction of the fragments; rather, it was about the entire process, from ‘equipping’ the fragments with metadata, through cleaning and smoothing processes, scanning and virtual puzzling, to the storage of the digitised objects and the digitally assembled pages.

This research and development project was uncharted territory for everyone involved as cleaning procedures, the inclusion of existing metadata in the puzzle

¹¹ Hanna Kannengießler and Jan Schneider recently presented an account of these processes and the ‘Digital Reconstruction of Cologne Fragments’, focussing on the technical aspects: Kannengießler and Schneider 2022; see also Fischer and Späinghaus 2019, 89–93.

¹² This technology, developed by Fraunhofer IPK, was used between 2007 and 2016 alongside manual reconstruction of torn State Security [‘Stasi’] files from the former GDR.

¹³ See also Schneider and Nickolay 2015.

algorithms and ultimately also an overall workflow for this process had to be developed from scratch. However, the project partners were able to draw on the existing Fraunhofer reconstruction (Reko) technology as well as on initial experience with the use of scanning technology already commercially available. Another new requirement was the development of a process that would tie up as few resources as possible in terms of archival and restoration specialists; these specialist professionals were to be available to work on those archival units that had been salvaged intact, thus making them available for consultation as quickly as possible.

By the end of the project in 2015, four important development goals were achieved that enabled the start of high-volume operations:

- An entirely newly developed digitisation unit with line scan cameras and its own control software.
- A cleaning workstation where fragile objects can be gently cleaned with cellulose particles.
- A newly developed reconstruction assistance system for the virtual reassembly of the fragments (the actual ‘puzzling’).
- A procedural outline that embeds these work steps in an overall process and compiles the technical and organisational framework conditions.

In 2015, the development project was successfully completed by proving the functionality of the four components. The task which now remained was to transfer the results and components obtained into an overall project in order to be able to work on a large part of the puzzle fragments in the medium term. To this end the software with its central AI components had to be converted into an intuitively usable system and above all had to be further trained technically with as many fragments as possible.¹⁴ At the same time, the technical expansion of the IT infrastructure had to be implemented and the archiving and restoration processes converted to a high-volume operation. This has been taking place since 2017 as part of the transition from prototype to a high-volume operation.

From the outset the scanning technology has never been a limiting factor as the technical processing can ‘keep up with almost any tempo’ by scaling the capacities of the IT components. The difficulty lies in the preliminary processes of archival triage (‘clearing’) and stabilisation (cleaning, smoothing). Since the beginning of the projects solutions have been sought both in-house and together with external

¹⁴ AI (or artificial intelligence) is represented in this project by its sub-areas of ‘pattern recognition’ and ‘adaptive learning systems’. This is also where in the case of the Cologne City Archive, the particular strengths of the use of technology for fragment reconstruction lie. However, according to the common definition, this constitutes a ‘weak AI’ [eine ‘schwache KI’], see Bitkom e.V. 2017, 29.

partners to speed up the restoration and conservation processes in particular. The development of efficient processes began even before 2015 with colleagues from the LVR Archive Consulting and Training Centre, where the processing of fragments for the Cologne City Archive was advanced using their own resources.¹⁵

In the following section a closer look will be taken at some of the processes used to reassemble digitally our fragments with the support of adaptive learning IT systems. Only the virtual reassembling of fragmented archive pages creates the basis for a later physical reconstruction, initially of the fragmented pages and ultimately of entire archival units (files).

To this end the images of the scanned fragments must first be looked at: as a first step these have to be quality-assured anew. Key to this quality assurance is the technically supported visual inspection of whether the torn edges of the fragments are correctly represented on the scanned image.

Metadata that is important in subsequent processes may also be added at this stage. For example, different types of series (e. g. fragments from consecutive pages of a file) can be labelled here. Moreover, information on languages and document types can be added if this information has not already been entered in the salvage entry or during the clearing process.

The additional metadata entered here is part of the ‘metadata rucksack’ in which the system summarises relevant data for each fragment and makes it usable for the technical processes. What data are these? Firstly, information entered during the early stages of salvaging and recovery is stored in the system for the fragments just like for any other salvage item. Then, the fragment folders, just like all other items, undergoes the so-called salvage registration, i. e. archival items were retrieved or compiled from the salvaged material box by box according to content and physical context; these were described or where possible assigned to a holding or a cataloguing unit. Each fragment now also has this information. In addition, there are special descriptive features entered during the clearing process (e. g. ‘sheet music’ for all music) as well as those entered after scanning. Needless to say, the storage and transport history of each fragment is also stored in full in the database.

This is the metadata that is contributed with the help of human intelligence. At this point, however, AI comes into play or rather the so-called ‘Reko-tags’ which are generated independently from the digitised fragments with the help of the software in complex pattern recognition processes. While these cannot be described here in detail, technical processes such as ‘polygonal approximation’ are standard

¹⁵ See e. g. <https://www.lvr.de/de/nav_main/derlvr/presse_1/pressemeldungen/press_report_archiv_13697.jsp> (last accessed 18 October 2023). A total of 182,461 fragments were prepared by the LVR for further processing.

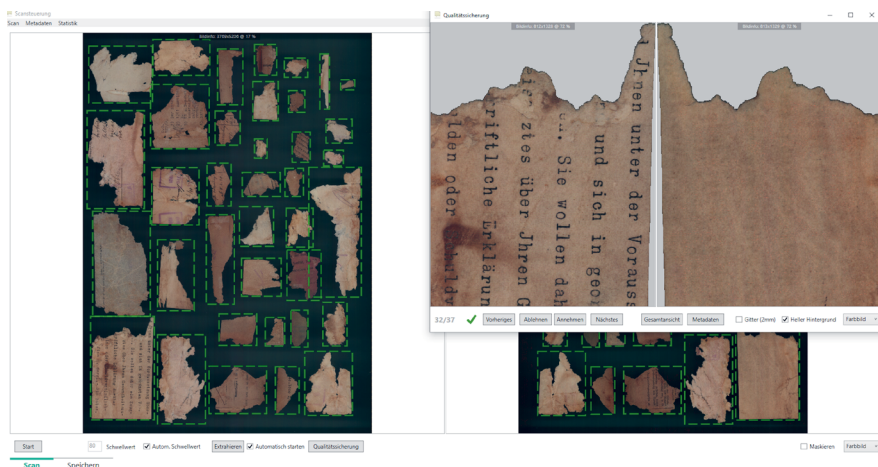


Fig. 2: Quality control on fragments. Photo: MusterFabrik Berlin

tools in digital pattern recognition. Various such tools are combined in the technology created by the MusterFabrik Berlin to form systems that make it possible to capture and describe all newly scanned fragments in such a way that they become available for a puzzle process of a constantly expanding total number of objects (Figure 2).

The technology developed by MusterFabrik Berlin allows fragments to be combined virtually in two steps. In a first step, the search space is reduced on the basis of all the metadata (manually entered along with the automatically extracted data) which means that subsets are formed from the total quantity of scanned fragments according to entered or automatically applied criteria. The automatically generated and stored colour values for paper and typeface play a major role here but other entered and extracted metadata (so-called ‘tags’) are also used. It is the creation of these subsets that ultimately allows automatic ‘matching’, i. e. the alignment of each edge with every other edge. Of course, the front and back of both fragments are taken into account during matching, though the automatically recognised outer edges of the leaves are also important. Complex algorithms are used to simplify the geometry of torn edges for preselection and to store section-by-section values for colours for ‘puzzling’.

The overall process is actually not that dissimilar to laying out a large jigsaw puzzle where we can observe ourselves carrying out similar steps. We also search for edges, sort by colour spaces and as a last step look at the contours. However, IT-supported pattern recognition is far ahead of us, especially when it comes to processing quantities.

Of course, a comprehensive technical infrastructure is required for this work. After our technical project partner was initially able to set up the technical infrastructure for local operation in our restoration centre, since 2021 the system for fragment reconstruction has been housed securely and in controlled climate conditions in the City of Cologne's computer centre. Many of the racks installed there for housing the digital reconstruction infrastructure are already filled with servers and digital storage systems and further growth may be expected. The application for the 'Digital Reconstruction of Cologne Fragments' (DRKF), by the way, is operated outside the actual municipal network which means that it can be administered and maintained remotely by MusterFabrik Berlin. Individual tasks can be carried out at different locations in Cologne and Berlin.

In the City Archive itself, in addition to the digitisation unit, several so-called 'puzzle workstations' are connected to a 10-gigabit line reserved for the DRKF. At these workstations staff can check and approve the puzzle results in parallel and control the systems, for example for defining and preparing puzzle sets.

But while the DRKF systems can sort the fragments into ever new search spaces at great speed and perform all conceivable puzzle steps they reach their limit elsewhere, as they are unable to read with understanding; it is even more impossible for them to match what has been read with the wealth of experience of the archive staff. For this reason fragment reconstruction was not implemented as an automatic puzzle procedure but as an assistance system. This is because fragments that match well in terms of metadata and torn-edge geometry do not necessarily come from the same page.

An example may illustrate this problem. A volume of a marriage register can contain up to approximately 500 sheets, each of which is printed with the identical sample form for the notarisation of marriages on the front and back; only case-specific data such as names, dates and if applicable document numbers and the like were entered individually by the registrar in each case. If in such a volume many of the pages that are largely identical due to the form used were torn in the same place and with the same pattern due to the collapse (we call this a 'soft series'), the AI can hardly recognise which of the fragments from the series belongs with a given counterpart. This can only be achieved by human intelligence because the human eye immediately recognises an inconsistency in content when reading with understanding. Since this is a common phenomenon the DRKF system does not automatically puzzle together the most probable fragments based on the tags and the torn edges but instead creates a hit list in which pairs of fragments are listed in descending order of probability. The decision to remove a hit – and thus to release for re-puzzling a new fragment formed from the two fragments – is made by the operator. And when the system recognises from the straight outer edges that a (nearly) complete page has been assembled it is presented to an archivist for approval.

Over 320,000 fragments were scanned by the end of 2022. The conservational processing of fragments, the scanning and preparation for puzzling by pattern recognition and the connected processes are ongoing. The support and further development together with the service provider also continue to yield good results but the corona restrictions and the move to the new purpose-built building at Eifelwall have led to a considerable reduction in the number of fragments scanned. However, the transfer of work specifications to new processes has recently been completed so that a moderate increase in throughput may be expected. In addition, as part of the budget planning for the clearing process at the end of 2021, open-ended assistant positions were established which will ensure the continuous operation of the Digital Reconstruction of Cologne Fragments.

This paves the way for the successful continued operation of the project. Of course, this does not mean that intensive development is not continuing in parallel. Thus, a new and more efficient wet cleaning and smoothing process was trialed and introduced in the new restoration workshop at Eifelwall. A considerable proportion of our fragments can now be prepared for scanning in a water bath which means that cleaning and preparatory conservation work such as securing breakage points etc. can be carried out with an improved throughput. The further expansion of the puzzle technology is also on track as is the constant adaptation of the AI to improve the results and the parallel operation of different workstations and in different search spaces.¹⁶

This also further improves the puzzle results. The still incomplete construction drawing shown in Figure 3 was digitally assembled from a total of 22 fragments in December 2021. Thanks to the continuous addition of new fragments and the performance of new runs with the Reko software, 13 further fragments were identified by the system by August 2022 which further complement the fragmented object.

But, of course, we are looking beyond this. What happens when individual ‘puzzled’ virtual pages are available again? In our terminology, these are ‘formation fragments’ that have to be re-combined into a complete file with other ‘puzzled’ and/or intact pages or parts of the file. A follow-on project for the software-supported Formation of Cologne Fragments is already in preparation with our partner, MusterFabrik Berlin.

Our long-term goal remains that we also want to make it possible to bring together physically the pages ‘puzzled’ digitally. While this is already being sup-

¹⁶ One example of a new development in 2021 is the ‘best-fit strategy’, which allows the search for fitting fragments from any given match of two or more fragments to continue until straight paper edges on all four sides indicate that a complete sheet of paper has been digitally reconstructed.

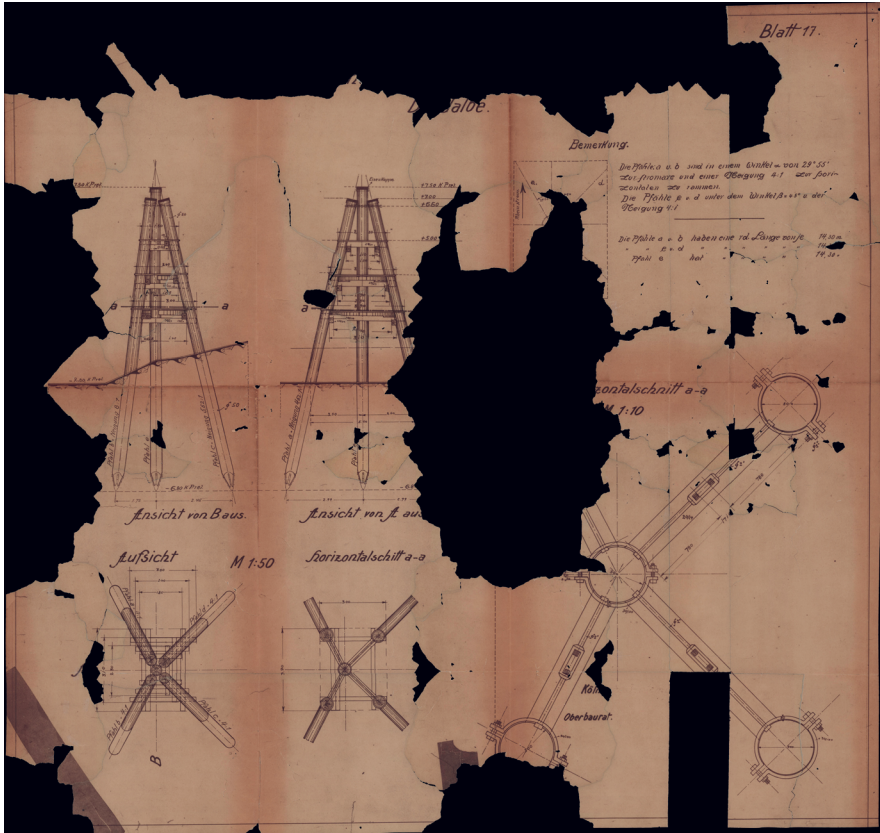


Fig. 3: HASTk, barcode 000497007. Fragment of a construction drawing, virtually assembled from 35 fragments (as of August 2022), MIMG-0006671871_100. Photo: MusterFabrik Berlin

ported by the system, bringing in conservators to reassemble the physical item is still a long way off, especially on a large scale. From a user's point of view, this is only urgent in rare cases. After all, the possibilities offered by IT enable these actually-lost archival documents to be used again – on screen.

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Simulating the Effect of Preservation Options – Are Archives More Complex than Rockets?

Abstract: The effect of preservation measures cannot be easily assessed in real time. Therefore, models are used to assist archives and libraries with decision-making, for example regarding storage strategies and the effect of different environmental conditions on the preservation of collections. Thanks to the major contributions made in the last decade we believe that we are embarking on a new phase in modelling where preservation is approached as a complex system. If so, we need to acknowledge that the global behaviour of a system is not the simple sum of the behaviour of its parts. Unexpected outcomes are common, for example, the same preservation measure might have a different impact when applied in different archives. This paper discusses how the concepts of complexity provide the basis for the models currently developed, e. g. the importance of capturing the heterogeneity of collections and inclusion of time-dependent measures. The challenges encountered by this approach are also addressed, for instance when other functions within the archives (e. g. providing access to the collections) are included in the model.

1 Introduction

Libraries and archives are responsible for the management of collections in order to ensure access for present and future generations. In view of this goal institutions face the challenge of determining to what extent preservation actions are beneficial in the context of their specific collections. Until now the traditional approach has been to evaluate preservation measures such as de-acidification or digitisation as single, independent processes. In reality, however, these actions are interrelated. If single preservation measures are put in the broader context of collection manage-

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ment then questions emerge such as: Are there management decisions which may have counter-intuitive and maybe unintended consequences? How do short- and long-term consequences of actions differ from each other?

In a broad number of fields these types of questions are being studied by approaching these problems as complex systems.¹ For example, it has been long advocated to recognise healthcare as a complex system,² resulting in a large corpus of studies where modelling and simulation paradigms of complex systems have been applied to explore the effect of policy interventions and the development of infectious disease in order to inform decision-making in healthcare.³

In the field of preservation a few examples can be found where the concept of complexity has been mentioned in relation to the preservation management of heritage collections. In 2013 Ashley-Smith used the concept of complex systems in the field of preservation management when he pointed out that heritage institutions are trying to find the balance between ‘four competing and interconnected outcomes: stability, cost, sustainability and accessibility. In such a complex system the optimal solution will probably be sub-optimal to at least one of the components’.⁴ In 2018 Henderson identified the importance of distinguishing between complicated and complex problems when discussing uncertainty in the context of preservation management planning.⁵ And only recently, a technical note has been published as an introduction of systems and systems thinking in the context of museums. The technical note concludes that ‘[r]egardless of the methodology employed, systems thinking is essential to improving understanding and managing conservation in museums, including collections environments’.⁶ Despite this work, up to now the implications of acknowledging preservation management of heritage collections as complex systems and consequently how simulation paradigms of complex systems could be developed to inform decision-making in the heritage field have not been investigated.

This paper will seek to address this gap by examining how general concepts of complex systems modelling can be of use in the preservation management of archival collections. The first sections of the paper will examine whether preservation management of collections can be defined as a complex system and if so which model paradigm would be the most adequate to model the system under study.

1 Serman 2000; Meadows 2009.

2 Plsek and Greenhalgh 2001; Homer and Hirsch 2006; Lipsitz 2012.

3 Salleh et al. 2017; Liu et al. 2018.

4 Ashley-Smith 2013, 30.

5 Henderson 2018, 108.

6 Henry 2023, 44.

In the second part of the paper a discussion will follow on how the concepts of complexity are included in the models that we are developing to understand the effect of different preservation decisions such as environmental storage conditions, deacidification or digitisation during the lifetime of collections to support preservation planning. The potential of this approach but also the challenges mostly related to the type of data needed for model development and application are discussed.⁷

2 Simple, Complicated and Complex Systems

Previous research tends to classify systems according to the problem that they address. Glouberman and Zimmerman use the following example when differentiating between simple, complicated and complex systems: whereas following a recipe would be characterised as a simple problem, sending a rocket to the moon and raising a child is a complicated problem and raising a child is a complex problem.⁸ Simple systems require mastering certain techniques or terminology but once these are acquired success is highly assured by simply following the recipe. In complicated systems the formulae are critical and necessary and high levels of expertise in a variety of fields may be necessary. But once the system has been formulated there is a high degree of certainty in the outcome, and the model is transferable to similar systems. In complex systems, on the other hand, formulae have limited applications because different initial conditions will result in different outcomes and there is no assurance of success when applying the same conceptualisation to the next system due to the level of ambiguity and uncertainty in the elements. Every system is unique and must be understood as an individual. Hence, all living systems, psychological systems and social systems are defined as complex.⁹

In general terms, complex systems have one or more of the following characteristics: large numbers of elements, large numbers of relationships among elements, nonlinear and discontinuous relationships and uncertain characteristics of elements and relationships.¹⁰ In particular, these systems are often characterised by their dynamic complexity. Such complexity arises from the interactions

⁷ A more extended discussion of these topics can be found in Duran Casablanca 2022, the PhD thesis on which this paper is based.

⁸ Glouberman and Zimmerman 2002, 1.

⁹ Poli 2013, 145.

¹⁰ Rouse 2015.

between the parts of the system, often leading to counterintuitive behaviour of complex systems.¹¹ Sterman has listed some of the causes of this dynamic complexity and why we are not good at understanding them.¹² For example, one characteristic of these systems is nonlinearity (where the effect is rarely proportional to cause) as not just one factor but usually a group of factors are involved in determining outcomes. Complexity also arises because the system is history-dependent, in other words, many actions are irreversible. In complex systems, cause and effect are distant in time and space resulting sometimes in counter-intuitive effects. Similarly, long- and short-term effects usually differ from each other, leading to policy-resilient decisions where an intended effect may have unintended consequences.

According to Marshall and Galea, in healthcare, the dynamic complexity of causes of disease emerges from certain characteristics.¹³ For the characteristics in these systems there are parallels in the archival and library collections, supporting the concept that complexity can be applied to collection management in archives:

- ‘Structural non-linear relationships (e. g. phase transitions) between causes and outcomes’:¹⁴ in the case of heritage collections, agents of deterioration should not be studied in isolation and the synergies among them (e. g. chemical degradation and the effects of mechanical forces during handling) should be taken into account.¹⁵
- ‘Feedback loops, such that causal effects are magnified (i. e. positive feedback) or dampened (i. e. negative feedback) as disease processes progress’:¹⁶ providing access to collections (in the short-term) without allowing for their preservation needs can have unintended long-term consequences, for instance, increased treatment costs.
- ‘Adaptivity, in that individual and population behaviour can evolve based on past history’ and ‘a high degree of sensitivity to initial conditions’:¹⁷ the initial conditions of the objects (paper quality) and their past history (whether the records have been heavily used or rehoused) can lead to different outcomes over the lifetime of the collections.

11 Forrester 1971.

12 Sterman 2006, 507.

13 Marshall and Galea 2015.

14 Marshall and Galea 2015, 93.

15 Taylor 2005, 138.

16 Marshall and Galea 2015, 93.

17 Marshall and Galea 2015, 93.

3 Archives as Complex Systems

To study the behaviour of systems, diagramming techniques are used such as causal loop diagrams, a tool used to capture the (causal) relationships within a system. As part of this research participatory sessions were organised and together with experts in the field from conservators and collection managers to archivists and digitisation experts a causal loop diagram was developed to capture the underlying causal structure to the following problem: What are the consequences of conservation measures and other archival functions on the preservation of paper-based archival collections and their physical and digital accessibility? In other words, the aim of drawing the diagram was to identify the variables to model how a collection can become vulnerable, understood as chemical degradation as well as wear and tear.

The causal loop diagram developed during the participatory sessions is shown in Figure 1. The diagram has been arranged so that the left side of the model includes variables related to the preservation aspects while the right side captures the dynamic of collections use. These two parts are directly linked to each other. Grey arrows show the variables related to the costs of the included actions. The diagram shows that preservation of the collections does not only depend on the measures that can be taken in the left part of the model (such as environmental conditions or deacidification) but also depends on how collections are used (which depends on the level of description or the popularity among the users) as well as on the available budget. In this system we can distinguish three parts that are interconnected but each part has its own dynamics and sub-purposes which do not necessarily contribute to the overall purpose. This conflict between sub-parts and in relation to the overall purpose is often seen as a characteristic of complex systems.

During the participatory sessions one aspect of the causal loop diagram was found to be confusing and difficult to use correctly, which also illustrates the complexity of the system under study. As positive and negative signs are used to indicate the polarity of the links among the variables a common mistake was to assume that an increase in a 'cause variable' will actually result in the increase of the 'result variable'. A positive link polarity means that when the causal variable increases the result variable also increases and when the causal variable decreases the result variable does too. A negative link polarity indicates that when the cause variable increases the result variable decreases, and the other way around also (when one decreases, the other one increases). In the case of preservation management most of the single relationships are linear (e. g. degree of polymerisation (DP) versus accumulation of wear and tear; temperature and relative humidity versus DP). But complexity arises because one output is the result of multiple inputs interacting over time (e. g. wear and tear depends on mechanical characteristics and use; and

mechanical characteristics depend on the chemical condition which depends on storage conditions as well as the initial pH and DP of the paper items). Participants recognised that decisions are very often taken based on assumptions of this type – that an increase in the cause variable will inevitably result in an increase of the effect. However, drawing a causal diagram made the participants aware that, in order to understand the output of a certain variable, all the input variables need to be taken into account and every single variable needs to be quantified. Participants agreed that causal loop diagrams helped to visualise the complexity of the system and the importance of taking all aspects into account in order to evaluate the effect of a certain decision.

4 Importance of Acknowledging Complexity

But why is it actually so important to acknowledge that we are dealing with a complex system and not with a complicated one? The distinction between a complicated system and a complex system lies in knowing what we can expect of the outcomes of the two systems. Whereas in complicated systems the problems can be (permanently) solved, in complex systems problems can be modified but not solved, since intervention generates new problems, as long as the structure of the system remains unchanged.¹⁸ By recognising that preservation management of archival collections can be understood as a complex system, we implicitly acknowledge that the problems cannot be solved. Nevertheless, we can still identify the places to intervene in the system which might turn into a leverage point.¹⁹

We have seen that whereas in a complicated system the output is always the same, in complex systems, unexpected outcomes are common. For example, the same preservation measure might have a different impact when applied in different types of collections, due to their different characteristics and use, but also depending on when the measures are applied. Therefore, when modelling this system, it is important to include the relationships that are responsible for the complexity in the system, in this case the initial characteristics of the collections (due to sensitivity to initial conditions) and how measures are applied over time (due to history-dependency).

One of the main characteristics of complex systems is their dynamic behaviour over time due to nonlinearity. In a causal loop diagram, non-linear behaviour

¹⁸ Poli 2013, 142.

¹⁹ Meadows 1999.

arises from reinforcing and balancing feedback loops as well as delays. Senge has identified some of the most common behaviour patterns that are found in complex systems: archetypes such as ‘limits to growth’, ‘escalation’ or ‘eroding goals’ have been described.²⁰ Two of these archetypes are of particular interest for us because they fit nicely with some of the observations made during the development of the causal loop diagram.

A first archetype that is worth highlighting is ‘shifting the burden’.²¹ According to this archetype a well-intended solution actually makes matters worse over the long term. During the participatory sessions it became clear that the concern exists that some measures are not being used efficiently (for instance vulnerable objects are still being used in the reading room while other objects with a lower mechanical risk have been digitised and are not further physically used). At the same time, measures to retard long-term chemical degradation of the paper are further delayed. Therefore, in the long term the increase of the collection becoming unfit might have gone unnoticed.

Another archetype that is likely common in archival institutions is ‘success to the successful’, ‘[t]wo activities compete for limited support or resources. The more successful one of them becomes, the more support it gains, thereby starving the other’.²² The benefits of digitisation, from enhancing access to the collections to reducing the risk of mechanical degradation due to handling, are clear. However, when digitisation gains more attention and, therefore, more resources, the budgets available for other preservation measures (e. g. remedial treatment) shrink.

Knowing that we are dealing with a complex system means the likelihood that conflicts between the subparts cannot be solved. But what we can do is to identify the places to intervene which may turn into a leverage point. Models are the tools that can help us to find these leverage points.

5 Modelling Preservation Measures

Complex systems are usually studied through simulation. Simulation has been defined as ‘the process of designing a model of a real system and conducting experiments with this model for the purpose of understanding the behaviour of the system and/or evaluating various strategies for the operation of the system’.²³ Hence, simu-

²⁰ Senge 1990.

²¹ Senge 1990, 380.

²² Senge 1990, 385.

²³ Shannon 1998, 7.

lation offers the possibility to use the model with the purpose of policy design: the model is used to test a number of policies or hypotheses and to clarify why different results are obtained, if it is accepted that the model (at least roughly) reproduces the behaviour of the real system. Simulation models are regarded as ‘tools for systematically attaining a better understanding of the real world and thereby for providing support for addressing the real-world management decision-making problems’.²⁴ The results are intended to inform policies and decision-making and in some cases to optimise the system.

There are different approaches to model complex systems depending on whether a macro or micro view is taken on the system: system dynamics with its macro-level approach or agent-based modelling with a micro-level approach.²⁵ If we opt for a macro approach then variables will be included that are related to the different processes. In this case the causal loop diagram could be used as a blueprint of the mathematical model where each interaction is formulated as a mathematical equation. At a macro-level the complexity emerges from the different parts that the whole system is composed of and whose purposes are not necessarily the same as the purpose of the whole system. In the case of the preservation management of archival collections we have identified three parts or, more specifically, three sub-systems: preservation, access and cost.

At a micro-level, complex systems are characterised by the many components (agents), with individual characteristics, interacting among each other and with their environment.²⁶ As mentioned before, professionals in the field of conservation are well aware that the same preservation measure might have a different impact depending on the different types of collections it is applied to and when the measure is taken. The agent-based modelling approach is closer to the system under study and allows microscale modelling to be applied where archival records represented by agents can undergo a specific development depending on chemical characteristics, instances of access or whether they have been deacidified or digitised. Agents are not homogeneous and differences between them in combination with the stochastic actions (e. g. accessed in the reading room or not; digitised or not) lead to the dynamic behaviour of the system. The outcome of two simulation experiments, even if they use the same configuration parameters, may be quite different. How different they are will depend on the particular variations that occur in each run and on how sensitive the system is, given its initial conditions.²⁷ It is nec-

²⁴ Rotaru et al. 2014, 85.

²⁵ Schieritz and Milling 2003; Djanatiev and German 2013.

²⁶ Borshchev and Filippov 2004; Macal 2010.

²⁷ Pidd 2014, 326.

essary, therefore, to repeat experiments multiple times in order to gain (statistical) confidence in the significance of the results obtained.

Since the main focus of interest is on the collections themselves, a micro approach seems a logical way to simulate how macro level management decisions are affecting the preservation and use of the collections at a micro level. Therefore, in this research agent-based modelling has been chosen as the modelling approach to simulate how the condition of the collections changes depending on the measures taken over time.

6 The Preservation and Access Sub-Model

Let us explore how the micro-approach of agent-based simulation can be applied to model the preservation and access part as defined as in the causal loop diagram.²⁸ In agent-based modelling, a population is created that is composed of agents. In the case of an archive, the population is the archival collection itself and each agent represents an archival record or a group of records with its own characteristics. The model is built according to two main hypotheses. In the preservation model the main hypothesis is that chemical degradation, understood as decrease in DP, depends on the pH of the paper, temperature and relative humidity, according to the dose-response function for acid-catalysed degradation.²⁹ Regarding the access part, agents defined as ‘popular’ will accumulate more instances of use and once they have been digitised they will no longer be accessed in the reading room. Therefore, in this research, agents are characterised by the following variables (Figure 2): in the preservation part, pH, DP and whether there have been deacidified; and in the access part, the number of times that an agent has been requested in the reading room (according to its popularity among readers) and whether it has been digitised. If wear and tear, understood as the accumulation of tears, is included in the model, then the number of tears is also a variable. Triggered by the changing values of the variables as result of the actions taken (e. g. storage conditions, deacidification treatments, or digitisation), agents go through different states (e. g. poor, fair, good condition).³⁰

²⁸ In this paper only the preservation and access sub-model are presented. However, the cost sub-model has also been developed and included in the PhD thesis. For a full description of the three sub-models (preservation, access and cost), see Duran Casablanacas 2022.

²⁹ Strlič et al. 2015.

³⁰ For a full description and application of the preservation and access sub-models, see Duran Casablanacas et al. 2019; Duran Casablanacas et al. 2021.

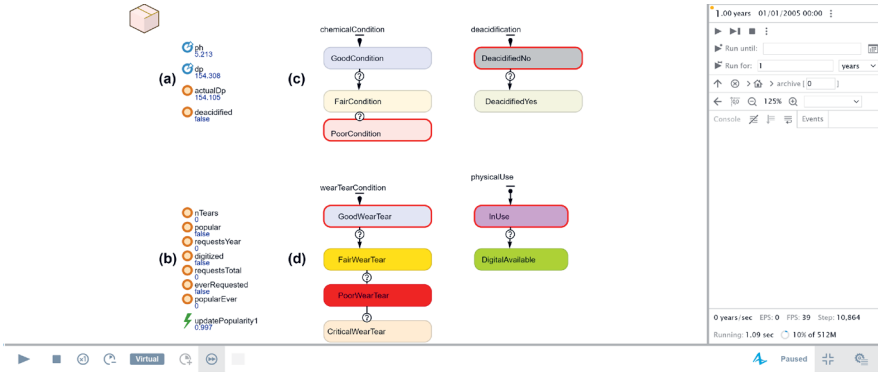


Fig. 2: Screenshot of variables and state-charts that define an agent, according to agent-based modelling, using the software AnyLogic 8.6. Changes in the state-charts regarding chemical condition (c) and wear and tear (d) are triggered by the changing values in the variables (respectively (a) and (b)), as a result of the preservation measures taken. The control panel (e) contains buttons for controlling model execution. Image: Cristina Duran Casablancas

Generated datasets representing archival collections and datasets obtained by sampling actual archives can be used as an input of the model. Through computational experiments, ‘what-if’ scenarios can then be tested. The simulation model is a virtual laboratory where the effects of duration and timing of various preservation measures can be explored through the possibility of virtual intervention at each step of the simulation run. In this approach we are modelling single items or a group of items but our actual goal is to model the effect of measures on the entire collection. The output of the model is dynamic, showing outputs over time. With these dynamic models we can explore the effect of preservation measures depending on the characteristics of the collection as well as the consequences of delaying or changing preservation strategies over time.

Up to now, in the models we are developing the core of the model is the collection itself and a limited number of variables identified in the causal loop diagram have been included in the model (Figure 3). With the simplification of the model variables which were originally described as endogenous variables (variables affected by other variables of the system) become exogenous variables (variables determined outside the model). For the access part of the model the model includes for now variables related to numerical data on the use of the collections and only one hypothesis is modelled: a decrease in requests in the reading room is the result of making the collections digitally available. In a more elaborated model, the omitted behavioural variables would need to be included, restoring the endogenous perspective of the system. The models could be further extended by modelling the variables that are involved in how decisions are made; for instance, in the case of the

access part by modelling the willingness of readers to use scan-on-demand service instead of accessing the originals. Herewith, other dynamic behaviours could be further explored, for example, how other strategies (e. g. reducing the delivery time of scans) would affect the use of the collections.

7 Potential and Challenges of the Proposed Approach

Compared to other models and tools one of the most innovative aspects of the proposed model is that the exploration of ‘what-if’ scenarios is at the core of the model. In the proposed model simulation modelling is applied to test preservation strategies where input data can adopt any value, not only at initialisation but also at any point in the lifetime of collections. The simulation model is designed to explore strategies by ‘playing’ with different inputs to learn more about the effect of actions. This is in essence different from other existing models such as the indoor climate evaluation models that use detailed data collected in repositories as input data³¹ and therefore not meant to inform long-term strategies. Although a limited range of aspects has been included for now in the model the applicability and value of the model as a virtual laboratory has been investigated to explore the effect of preservation actions which cannot be tested in the real world: for example, exploring the effect of maintaining the present preservation strategy, taking instant action by the deacidification of the acidic part of the collection, or taking the long-term measure of changing the storage environment.³² The model has shown its value in permitting micro-simulations that allow all combinations to be tested from different types of collections to the duration and timing of measures. Being able to fully explore possible scenarios provides decision makers with more valuable information to decide which is the ‘best’ option for their own collection than if they were merely briefed about expected results.

However, like any model, the proposed approach presents challenges, namely related to the uncertainty present in the model. Where possible, well-accepted models have been included. But even these models are subject to limitations and uncertainties due to assumptions and simplifications. For example, cellulose degradation models deal with the uncertainties related to the use of artificial ageing to study the kinetics of cellulose degradation. In addition, even the measuring of

31 Cosaert and Beltran 2021.

32 Duran Casablancas et al. 2019.

pH and DP is still a matter of discussion, particularly for groundwood paper which constitutes an important group of interest, due to the higher risk of reaching a DP of 300 within 500 years in standard storage conditions of 18°C and 50% relative humidity. It is also worth mentioning that this time horizon of 500 years is chosen in our interest since the longer the projection, the larger the error of the estimation. Further research is needed in uncertainty propagation and its implications for decision-making.

One of the most important features in agent-based modelling is that agents in our case archival records can be characterised in detail. For example, one variable that would be worth exploring in future research is the date of the records. This new level of information might be relevant to determine the material characteristics of the records (e. g. rag, bleached pulp or groundwood paper) in combination with the probability of being accessed in the reading room or made available digitally.

The model can thus be easily extended with new variables to further characterise the agents and therefore their behaviour. It is clear that in order to increase confidence on this type of model a larger corpus of historical data is imperative to further develop hypotheses to validate parts of the model and to be used as input data of the model. Although the benefits of using historical data are well-known, working with historical data is paired with challenges since this type of data cannot be 'controlled'. Until a larger corpus of data is available, results will need to be interpreted with caution and further testing with other scenarios will be necessary before using it in a universal predictive capacity in new archives.

In summary, the main feature of the approach, the great level of detail to capture heterogeneity of the agents, is at the same time the major pitfall: from the extensive number of inputs needed to the opacity of grasping how the outputs are generated. Potentially, the model could be further extended by modelling some of the exogenous variables endogenously, as seen in the causal loop diagram. However, completeness should not be a goal when modelling and the model should include as many variables as needed but not more. As Oberkampff et al. have observed, 'the predictive power of a model depends on its ability to correctly identify the dominant controlling factors and their influences, not upon its completeness or complexity. A model of limited, but known, applicability is often more useful than a more complex model'.³³

33 Oberkampff et al. 2002, 338.

8 The Richness of Data Analysis

When developing a mathematical model each variable needs to be defined. Analysis of historical data is therefore required to develop the model but also if we want to customise the inputs according to the characteristics of our own collection. This is particularly true for the access part of the model that uses information on the usage of the archival records that is automatically generated and stored by collection management systems. The analysis of this data is in itself a rich source of information, as illustrated by the examples given in this section.³⁴

For example, the data analysis of usage and digitisation data in several Dutch archives conducted within this research has shown that scan-on-demand is succeeding in digitising the records frequently accessed in the reading room, since the readers are the ones making the selection. Interestingly, digitisation projects started by the institution itself are slightly less successful on this front either because whole archives are selected for digitisation (including records that have never been accessed) or because popularity of the archive is not the only driver behind digitisation projects. Consequently, what we see is that those archives that are experiencing a decline in requests in the reading room are those that are successfully digitising the most popular records among the readers and these are the archives that offer the scan-on-demand service.

If data analysis is further conducted to find out whether certain records are more frequently requested than others then a Pareto distribution is frequently found.³⁵ The Pareto distribution shows that in a period of ten years between 55% and 65% of the records requested in the reading room have only been accessed once whereas a small percentage (<1%) has been accessed on average one or more times per year. From a preservation point of view and looking at this data, no models are needed to draw the conclusion that just targeting this highly requested group of records would be a very efficient strategy with a high impact on the reduction of wear and tear due to handling.

From these results and elaborating on this idea of looking at processes not in isolation but as part of a larger system, then a new question arises, namely at what point is it more cost-effective to digitise a record than to provide access to it in the reading room? To answer this question we calculated the cumulative costs of proving access, either digital or in the reading room.³⁶ This calculation makes it pos-

³⁴ For a detailed description of these examples, see Duran Casablanca 2022, Chapter 5 and 7.

³⁵ Duran Casablanca 2022, 31.

³⁶ The proposed cost model is available at <https://github.com/cristinadur/APMcostmodel/blob/main/Life%20cycle%20collection%20management%20costs_04.xlsx> (last accessed 24 October 2023).

sible to find out how many times a record would have to be requested in the reading room in order to break even with the costs of making it digitally available. The calculation will differ between institutions depending on the chosen scan quality and the costs of consultation in the reading room. However, as an indication, in the case of the Amsterdam City Archives it has been calculated that after five requests in the reading room the point has been reached at which making and keeping a scan available is more cost-effective.³⁷

Looking at these results, can one really conclude that providing digital collection access is a cost-effective strategy compared to providing access in the reading room? To answer this question we need to take into account the statistics that show how often records are repeatedly requested in the reading room. In the case of the Amsterdam City Archives, as mentioned, following a Pareto distribution, over a period of 20 years, over 50% of the requested records were requested just once and 8% had been requested more than five times. Taking these statistics into account, from a cost-efficiency point of view, only a small portion of the requested records in the reading room will be more cost-effectively accessed through digitisation than in the reading room within a period of 20 years. These results illustrate the importance of using data analysis to inform digitisation strategies that support how the institution envisions the use of the collections beyond the reading room.

9 Conclusions

In this paper it has been argued that the preservation management of archival collections is a complex system composed of three sub-systems – preservation, access and cost. Acknowledging that we are dealing with a complex system means that conflicts between the sub-parts might not be solvable. Nevertheless, the use of models can be a very effective communication tool to compare and show the effect of different options and whether leverage points can still be identified where intervention may be fruitful.

System dynamics and agent-based modelling are common to model complex systems. In this research, agent-based modelling has been chosen to simulate the effect of preservation measures over time. Agent-based modelling makes it possible to capture the heterogeneity of the collections as well as the randomness of some of the processes such as the access of the collections. The level of detail when describing the agents, in this case archival records, seems endless, and it might be tempting

37 For a detailed description of this example, see Duran Casablanças 2022, 251–260.

to try to reproduce the actual collections in all their features. Therefore, the main pitfall of this type of models is that due to high level of detail the model becomes a dark box and, consequently, a less powerful communication tool.

The greatest value of the model is when processes in the long term, for example the effect of storage conditions or deacidification on the chemical degradation of the collections, are investigated by means of scenario modelling. When exploring processes in the short term such as digitisation, ‘what-if’ scenarios can be still relevant to further refine and extend the results of data analysis. However, data analysis, without further modelling, can be very enlightening if the relationships between processes are taken into account during the analysis. For example, data analysis might be sufficient to inform digitisation strategies if data analysis is structurally implemented by identifying users’ needs and behaviours, evaluating the expected reduction of handling of original items or assessing the differences between the expected and actual performance of digitisation programmes.

In this paper, the complexity of the preservation management of collections has been investigated at a micro-level, taking the collections as a point of departure. To further investigate the complexity in archives, future research could assess potentially conflicting goals between the sub-systems as well as synergies, since activities started in a sub-system might have beneficial (side-)effects in other parts of the system and become more visible if other simulation paradigms such as system dynamics are applied to model collection management activities at a macro-level.

The focus of the paper was primarily on archives and the proposed models have mostly been tested for archival paper collections. Although it can be expected that most of the findings are also relevant to library collections, further research is needed to investigate whether the dynamics seen in the model are also applicable to other memory institutions.

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Disposal of Documents After Mass Digitisation

Abstract: The paper focuses on how a reliable implementation model, a meaningful schedule and a reasonable cost structure in terms of long-term digital preservation and usability of digital manifestations can be implemented in a large-scale digitisation production. Not all records are suitable for large-scale mass digitisation. The fragile condition of the material, its cultural-historical value or restricted personal data may be grounds for exclusion from the service. By exclusion, worst risk scenarios regarding disposal-oriented digitisation can be dealt with. Production can be effective and credible only if the material has been carefully reviewed, e. g. through pilot test production. This applies to both cost structure and qualitative target points. Competent staff can increase autonomy as turnkey solutions often do not exist and cut ongoing maintenance costs. Image quality, content recognition, file format and archival transfer package are key requirements but achieving them in a large-scale production requires sophisticated and both automated and human-based implementations throughout the digitisation process. The final disposal process requires quality control checkpoints at various stages of the digitisation process, complemented by customer testing of the access files and a secure disposal procedure.

This chapter focuses on the digitisation of the official documents created by ministries or other central government agencies. Documents with no cultural-historical value (typically less than hundred-year-old documents) are digitised in the mass digitisation process and disposed after that. Documents with cultural-historical value (typically more than hundred-year-old documents) are digitised in the retroactive digitisation process. In both cases the digital manifestations of these documents will be archived permanently.

1 Introduction: Which Documents Are Destroyed and on What Grounds?

Documents formed in Finland are now stored primarily in digital format. The main reason is that they are born digital and used mainly in digital services. Previously

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the Archives Act required that documents stored permanently must be stored in analogue format (usually on paper). Because of this large numbers of born-digital documents were converted to paper format only so that they could be transferred to the National Archives after their original purpose of use had ended. The central government's decreasing archive storage facilities and the increasingly faster handling of matters has encouraged the authorities to transfer documents to the National Archives (NAF) more and more quickly as a result of which the National Archives waived the previous age of forty years as a condition for handing over documents. This accelerating circulation of documents, the general digitalisation of document management and the objectives of the Government Programme to significantly promote the digitalisation of paper materials led to amendments to the Archives Act in 2019.

Under current legislation paper documents can be converted and permanently preserved in digital format provided that their preservation, integrity, authenticity, cultural-historical value and legal weight as evidence are not compromised. Consequently, the National Archives has stated that permanently archived documents can only be transferred to the National Archives in digital format (i. e. born-digital or, in the case of paper documents, equipped with a contract regarding the digitisation responsibilities). Authorities can implement the digitisation themselves or purchase it as a service from private service providers or the National Archives.¹ Certain fixed-format documents are accepted into the mass digitisation service of the National Archives; in this case, the National Archives is practically responsible for the costs of digitisation. However, the current mass digitisation production capacity enables only a relatively limited annual amount of digitisation (approximately 1,500–2,000 metres of shelves) whereas over 125 kilometres of shelves of documents suitable for mass digitisation have been identified as still in the possession of the authorities.

Since then, the availability of documents in digital format has also been required by legislation other than the Archives Act. The relevant legislation is currently being updated² which is practically the new prevailing status quo; from the point of view

¹ As NAF approves official documents only digitally but there have been only a few operators so far, not to mention the governmental agencies themselves, with necessary expertise to provide digitisation services efficiently, it has been deemed appropriate that NAF provides these services to a certain extent as well. Requirements for the disposal-oriented digitisation are always the same regardless of the service provider.

² Act on Information Management in Public Administration (2019) changed somewhat the terminology of permanent preservation and/or archiving in Finland. According to this Act the 'data material' is first in the 'preserving stage' (still necessary for the records creator agency). Therefore, there can be permanent preservation for the original purpose of the document while it is still being

of Finnish legislation digital documents are as authentic as analogue ones. They are not copies as they are original and unaltered documents based on their data content and context. Actually, the focus of the debate in the governmental records management services has shifted from mere digitisation to digitalisation; providing citizen-centred and interoperable digital services is one of the key strategic goals of public administration in Finland. In addition to digitisation the current emphasis is thus on digitalisation which are prerequisites for each other. In addition to the actual services (systems) digitalisation refers to artificial intelligence supported systems or otherwise more versatile ways to search for content in born-digital and digitised material.

To summarise, the vast majority of the materials to be transferred to the National Archives are permanently stored only in digital format. Since its appraisal strategy in 2012 the National Archives itself has aimed to ensure that archived (permanently stored) documents are kept exclusively in electronic form whenever possible while digital preservation also allows for a larger share of the materials to be preserved. Previously, when the materials had to be preserved in paper form the aim was to dispose of up to 85–90% of them on a fixed-term basis. With regard to digital preservation a corresponding quantitative target for the share of material to be archived permanently has not been made, at least not so far.

When it comes to analogue documents their archival storage form is decided before they are transferred to the National Archives. The owner of the materials (an authority) prepares the proposal and the National Archives makes the actual decision. The assessment of the preservation form is based on the National Archives valuation and appraisal policy document and above all the guidelines for the categories and criteria for the valuation of the preservation form attached to it. In practice, therefore, authorities can propose to the National Archives that the document be archived in analogue (mostly paper) format on the basis of its cultural-historical value. This division of duties may change in the future so that the authority decides more and more independently both on the form of storage of its materials and on their possible cultural-historical value. However, the prerequisite is that the authority documents the decision and the reasons so that it can demonstrate, on request, how the valuation criteria of the National Archives were applied in the decision.

What is meant by cultural-historical value? Internationally, the term ‘intrinsic value’ has usually been used to refer to the material value of records. In Finland

held by the agency. After the original purpose has expired, NAF can stipulate ‘data material’ to be ‘permanently archived’. The situation is somewhat incomplete since the Archival Act is currently being reformed and consequently the concepts can change. Finally, it must be pointed out that even documents which are still in the ‘preserving stage’ can be transferred to NAF for digitisation.

the National Archives' definition of cultural-historical value includes both evidential and informative value. The values can therefore be tangible or intangible but still linked to the analogue manifestation of the document. Cultural-historical value, i. e. material value, is related to the features of a record – for example, a special analogue format such as a glass negative or parchment. The value can lie in the material itself or in the information it contains which cannot reliably be preserved in any other manifestation (format).³

Preservation in analogue format requires that the conditions of at least two valuation criteria are met. The first criterion that is required in all cases is the criterion according to which the condition of the document must be such that it can be permanently preserved in analogue format; for example, the record is not severely mouldy or damaged in any other way so that it cannot be used or preserved. Furthermore, the material of the record cannot be self-destructive. As far as the other criteria are concerned, perhaps the most commonly referred to is age: documents dated older than 1921 are kept in an analogue format. The criterion is not mandatory, which means that a record that dates from 1921 or later may be preserved in analogue format despite digitising if another criterion of the preservation format's cultural-historical value is fulfilled. There is a total of ten criteria including special material features, information (which the digital manifestation cannot convey), artistic or aesthetic qualities and rarity or uniqueness.⁴

However, it is worth noting that preservation in paper form does not necessarily mean that the original form is preserved completely. The decision on the storage format is therefore not strictly museological or related to the object value; instead, it can be related to paper quality, text with markings and standard forms (stamp, handwriting, form, ink, etc.).

In accordance with this principle the valuation criteria will possibly be refined so that only a certain part of archival units will be retained in their original form, and those whose digitisation would not be possible except by untying the bonds into loose sheets (by damaging the original structure of the archival unit) will be converted into loose sheets required for digitisation. In this case, culturally-historically valuable materials would be stored in paper form but not comprehensively as original objects.

³ For example, some archival volumes can be seen as exemplaries of a certain period and therefore will be preserved. In some cases, cutting an archival volume into loose sheet could lead to loss of information.

⁴ Cultural-historical value criteria (in Finnish): <<https://kansallisarkisto.fi/documents/141232930/149322637/Kult.+hist.+arvon+kriteerit+ja+soveltamisohje.pdf/5c4a7577-17d3-4ccc-5c0b-41514e3690d8/Kult.+hist.+arvon+kriteerit+ja+soveltamisohje.pdf?t=1705666066988>> (last accessed 23 April 2024).

A fairly large proportion of the materials held by the National Archives are of cultural-historical significance but only a very small proportion of the materials held by the authorities. It is worth noting that the cultural-historically valuable materials that are currently being digitised are in practice stored both in analogue and digital permanent forms.

Some of the documents previously ordered to be preserved in analogue format can later be ordered to be archived in digital format only. In addition to the materials in the possession of the authorities this principle applies primarily to materials already in the possession of the National Archives, the total amount of which is about 240 kilometres of shelves at the moment.⁵ Digitisation has been done in the National Archives for more than twenty years but these materials have not been destroyed afterwards despite legislative changes in recent years. The main reason for this is probably that the quality of digitisation has not been monitored in the same way as in digitisation aimed at disposal because the aim of digitisation was to produce digital copies of the actual analogue documents to be stored for customers. Currently, the National Archives' own digitisation (retroactive digitisation) implements mainly the criteria for digitisation aimed at disposal in terms of image quality and file structure but content quality control (validation) has not yet been implemented as systematically as in the production of mass digitisation.

In practice only few archive series digitised in the National Archives have been destroyed after digitisation. However, no principle prevents the updating of the decisions on the preservation forms of materials held by the National Archives, that is, the decisions on the permanent preservation of materials in digital format. Before we can move on to this the quality control methods of retrospective digitisation and probably the whole implementation model and process of digitisation must be refined and combined with the corresponding methods and processes of mass digitisation. Increasingly decreasing storage space urges development in this direction but the lack of space could be alleviated more quickly by identifying materials that are not expedient to preserve at all.⁶ Regrettably, the National Archives has received interim archive material or documents whose permanent archiving could be challenged retrospectively. Of course, these measures would require additional resources for the identification of materials and practical appraisal work; nevertheless, it should be noted that a fairly significant part of the archive material held by the National Archives is dated before 1921 (cautiously estimated at 30–40%) and will therefore be preserved in analogue format in any case.

⁵ Estimated in 2022.

⁶ It is challenging to get funding in the state budget allocated for archive storage facilities. The NAF's latest archive facility was inaugurated in 2017 and free storage space is already becoming scarce.

To summarise, the analogue manifestations of materials to be transferred to the National Archives and converted into digital format are the primary objects of disposal in the current digitalisation planning.

2 Conditions and Terms for Disposal

Disposal-oriented digitisation (a digitisation process specifically designed for the disposal of digitised analogue documents) has been implemented in the mass digitisation production of the National Archives since 2019. It is not only about constructing a production and implementation model of digitisation but also about the administrative guidance required for it, preparing the storage form described above and designing a plan for the documents to be selected for mass digitisation (selection of archive collections/series and the order of digitisation). For the sake of clarity it is stated once again that the National Archives stores documents in digital format and thus disposes of only such analogue objects that are permanently stored. Permanently stored documents refer to documents in the archiving stage in accordance with the Finnish Archives Act, the Act on Information Management in Public Administration and the EU General Data Protection Regulation. However, it should be noted that such documents can be transferred to the National Archives and digitised before they enter the archiving stage. The documents must be digitised in accordance with the National Archives' regulation concerning the requirements for the disposal-oriented digitisation. These are, in a way, the starting points and basic prerequisites when starting to look at the disposal of analogue materials.

At present the National Archives is running a pilot of digitised analogue documents' disposal process. Why has it not been done before – indeed, why was disposal not started at the same time as other processing stages of digitisation aiming at disposal? Mass digitisation had to be piloted at the very beginning and it was necessary to ensure that the production would form compliant transfer packages that meet the quality requirements for disposal. We also wanted to ensure that digitisation proceeds at approximately the set speed so that it covers the entire dataset precisely.

Disposal was not prevented by a lack of a long-term storage system required for permanent storage. The KP-PAS service (long-term storage system for the cultural-historical objects), which is a ministry-managed system and therefore external to the National Archives, has been available before and since the mass digitisation was launched the National Archive's own electronic archiving system SAPA was developed between KP-PAS and digitisation production (the digitisation system was directly integrated to SAPA at the end of 2020). SAPA has been found to be highly functional and reliable; in practice it receives the digital materials produced by

digitisation and creates the necessary user copies to digital services intended for customers through interfaces in accordance with the information system model. From the point of view of digitisation SAPA is one of the guarantors and metrics of quality as it only accepts transfer packages that comply with the requirement specifications. In other words, the introduction of SAPA has in its way created a better starting point for launching disposal.

Waiting for customer feedback as well as seeing and evaluating the end product in the customer interface have been very important reasons for the delay in launching the disposal. Mass digitisation began before the required changes that would allow the user to view the materials or images had been properly made to the customer system. ASTIA (customer service developed to search and view all the documents transferred in the NAF) allows you to not only view the material but also search for content using the OCR content identification search carried out in mass digitisation. The challenge has been that the database information (e. g. latest archive material available in digital form) is not updated to the ASTIA system in real time but with certain intervals. The difference between completing the digitisation and updating the ASTIA database may have been up to several months. Content recognition is updated as a separate entity and there have also been delays. In addition, the OCR search had to be limited to only concern the archive unit (not, e. g., the whole archive). The quality of the recognition has not been scrutinised efficiently so far either (there is an AI development project going on at present to improve the reliability of the identification). For these reasons it has been difficult to assess the quality of the content identification of digitisation and the reliability of digitisation itself through wider datasets. After all, digitisation production software has no system available that can easily and comprehensively cover the resulting image sets. Images are reviewed in scanning and validation applications but only in limited batches and momentarily. It is somewhat paradoxical that even the employees working with mass digitisation have not been able to comprehensively see the digital materials they have produced.

For the same reason we have only very recently been able to receive feedback on the 'end product' – the images – from the customers themselves. However, there are also other reasons for this: in mass digitisation the material to be digitised is mainly still in the preserving stage and as a rule contains information that is restricted for use on various grounds.⁷ Therefore, it is not freely available but principally only accessible to identified users of the official organisation that handed it over. Even after the materials have become more available in the ASTIA system, their use and the evaluation of quality has been dependent on how the relevant

⁷ See footnote 2.

authority needs to use these materials. The situation is therefore different from that of completely public materials where customers typically provide the National Archives with immediate and abundant feedback on deficiencies or quality deviations.

This does not mean that the rate of use was low. On the contrary, the rate of use of the mass digitisation materials has been steadily increasing, which is logical in the sense that mass digitisation seeks to identify and include materials that are frequently consulted. Nevertheless, it has been necessary to wait several years so that customers could have the opportunity to give feedback on the quality of digitisation before disposing of the original analogue materials.

Finally, the most important reason for the delay in launching the disposal has been that the disposal itself requires its own process – both logistically in terms of the implementation of the actual physical disposal of the analogue material and in terms of the related information system functionalities. The first years of mass digitisation have focused on building steady, stable and reliable digitisation and there have been no resources for disposal process issues; disposal has not been a main priority. It has also been considered that disposal – as an extreme, irreversible measure – requires a certain maturity of the organisation and a deeper understanding of the fundamentals of its activities, although disposal like any process or part of a process inevitably requires a certain level of experimentation and piloting at the initial stage. It is not an area of digitisation that one would want to implement more generally on digitisation production that is in the start-up or pilot stage. Ultimately it is a matter of assessing and identifying when the time is truly ripe for activities such as disposal.

The development of recent years has forced us to reflect on this question and brought new perspectives to its evaluation. The National Archives' storage facilities are filling up and at the same premises could be vacated. In the future there will therefore probably be less storage space available although the authorities still have at least a few hundred kilometres of documents in their possession that will be transferred to the National Archives (mass digitisation-oriented and others). By the end of 2023 more than six kilometres of materials will have already been digitised in mass digitisation. As the storage space decreases the pressure to dispose of materials that have already been digitised is continuously increasing. There is no actual justification for preservation as the use of the mass-digitised documents has genuinely moved to digital forms.

Of course, the launch of the disposal is also related to the public image of the National Archives and in particular the mass digitisation function. The key difference between mass digitisation and traditional digitisation is precisely the disposal of the original format. As long as it is not done the mass digitisation is not materially different from other forms of digitisation.

In order to start the implementation of the disposal it is necessary to first define its conditions. These are the so-called criteria for the disposal of mass digitised analogue documents. Each criterion must be fulfilled before the dataset can be considered to have been properly disposed of. The following briefly describes the conditions for disposal in the order of the digitisation process.

2.1 Ensuring Storage and Preservation Format

Mass digitisation contracts have been signed. National Archives and the transferring authority have drawn up a mass digitisation agreement for the materials. The agreement is standardised and will only be drawn up for datasets whose permanent preservation value and permanent preservation in digital format has been confirmed. On the basis of the agreement the National Archives agrees to be responsible for the digitisation of the materials in accordance with the criteria for digitisation aimed at disposal and on the other hand receives permission from the authority to dispose of the analogue materials after ensuring proper digitisation without a separate notice or permission. As part of the agreement the materials are also specified and a joint risk assessment is usually performed, which must be taken into account when digitising and disposing of the material.

2.2 Metadata

The metadata must have been fed into the AHAA (the NAF's cataloguing metadata system) and been approved by the NAF and the 'possession status' must have been changed from the governmental agency to the NAF (for further measures). In practice the only action required from the authority is to add metadata on the content of the materials into the AHAA; this is the authority's task as it knows the materials. However, it is also important because the authority decides and is responsible for the order of the materials and the metadata related to them. The National Archives does not change the order or metadata in any way at any stage of digitisation. This principle is important in terms of the integrity, originality and authenticity of the materials. The authority also prints out the barcodes it generates from the AHAA database and attaches them to the archival units. The materials are monitored during digitisation with the help of barcodes; they also help to ensure that the order is maintained and that the materials are not lost during the process.

2.3 Reception Inspection

After the metadata is approved the materials are transferred to the National Archives. NAF checks and compares the analogue materials quantitatively and partly in terms of their content with the information presented about it in AHAA. When the inspection is complete the approval certificate is delivered to the authority that transferred the records. If the shelf and database information differ the necessary modifications are made to the database or the materials forgotten from the transfer are submitted to the National Archives.

2.4 The Contents of the Digital Materials Have Been Verified

Mass digitisation uses a validation programme built by the National Archives' application development unit. The validation programme reviews 100% of digitised material. In practice each image is checked by the operator (in the near future, at least some of the materials will be pre-screened using AI-supported API components). In order to ensure integrity, originality and authenticity it is not enough that the actual data content of the image (document) is readable – the digital object must perfectly correspond to the visual recognition of the original analogue document. The image file must not include any elements that are not included in the analogue counterpart. It should be noted that the image quality is also not improved with AI or photo editing solutions even if the original document is in poor condition (for example, if it is a photocopy or a sheet where the text is hard to read).

The aim is to ensure that the front and back sides of the sheets are scanned by using optical readers to identify possible double and error inputs and by carefully monitoring the image queue during scanning.⁸ We mean to identify and mark any small-sized labels and loose papers already at the material's preparation stage before the scanning stage. Overall, it is a question of staff training and experience, that is, professional skills. A professional operator can identify any missing sheets even in the image queues during validation.

⁸ When purchasing equipment, preference is given to equipment that has a higher performance in separating documents from each other

2.5 File Structure Approval and Transfer

The file structure and usually the technical process of image creation are based on the National Archives' regulation on digitisation aimed at disposal, which has been drawn up taking into account the standards commonly used in the archives sector and the quality requirements for digitisation of other national archives. Additionally, the acceptable formats and the package to be formed in the digitisation process have been defined with the national requirements set by the long-term storage services (KP-PAS) for stored materials in mind.

When scanning materials only equipment whose performance meets the requirements of the aforementioned regulation – both in terms of manufacturer specifications and actual tests – is used. The performance of the equipment is optimised with the quality of the image files verified on each production day using measurement tables designed for it (UTT target). The test is repeated as many times as necessary until the requirements are passed (if not, the equipment is subjected to the necessary cleaning or repair procedures).⁹

It is perhaps more important than the technical specifications of image files that the image files are in lossy compression format (JPEG) and that they are not processed and saved again after the first processing. Content identification is performed in ALTO format and metadata concerning the image file's creation history is presented in accordance with the MIX meta scheme. It is very important that digitisation does not only produce high-quality images but also stores key information about the digitisation process itself. A transfer package compliant with the requirements includes the master file, the OCR file (XML-ALTO) and the MIX metadata files. The transfer package is in TAR format (no compression used). Each batch has a separate JSON file containing batch-related information such as transfer type and TAR package checksum which is made by MD5 hashing. After a successful SAPA transfer the original files are automatically deleted from the Mass digitisation servers (but only after a short retention period).

The verification of the technical characteristics of image packages is fully automated in the transfer application devised by the National Archives' product development. Images will not proceed to later processing stages such as content identification if the figures in the MD5 inspection do not match. The TAR package is checked when transferring batches to the SAPA system. In a way, there are three verification steps because the information is also checked when transferred to the KP-PAS long-term storage. It is worth comparing the number of inspections of the

⁹ The quality is measured with iQ-Analyzer software: Metamorphose extra-light standard with few adjustments.

digital material with the corresponding number of inspections of analogue material, for example when transferring materials traditionally from an authority to an archive – it is clear that digital materials are inspected much more comprehensively than analogue materials. Although there are always risks with the transfer and processing of all materials the risks can be considered smaller thanks to the comprehensive inspection of digital materials.

2.6 Metadata Life-Cycle Information

As part of the technical package's transfer, the information concerning it must also be stored in the metadata system. SAPA transmits information to the AHAA system about the successful transfer of the materials to the KP-PAS long-term storage.¹⁰ What is most important is that information regarding the digital manifestation must be connected in the archival unit in the AHAA metadata system.

2.7 Image Content Inspection (Part II)

In the event that the materials have not been used significantly by the customer random sampling will be used to check that all the materials are in the ASTIA system after the end of digitisation in the mass digitisation process. This constitutes the third content inspection stage after scanning and validation. This sampling inspection has been used for a long time in the process of mass digitisation and it is possible that when the disposal starts, the scope of the sampling will be further increased.

2.8 Retention Period

The materials will not be disposed of directly after the completion of the digitisation, but after a retention period. Its final duration is still to be determined but for the time being the minimum retention period is set to six months. At the system level the retention period will be connected to the content inspection of the materials in the ASTIA system after the digitisation is completed.

¹⁰ PAS-AIP-ID (storage package identifier in the KP-PAS system).

3 Piloting the Disposal

Before the actual regular disposal operations begin the operations are tested by piloting the planned disposal implementation model and ensuring that the changes it requires for the information system function as intended. The pilot focuses on assessing whether the metadata of the life cycle of the materials and information on the measures of disposal itself are saved. It is important to gain experience on how easily manageable and controlled the launch and control of disposal is from the point of view of using the application controlling it on one hand and on the other hand as a logistic entity (collection of materials and physical disposal). The effectiveness of the operations and the appropriateness of the implementation method are also evaluated. As a whole the disposal pilot evaluates whether the outlined implementation method is such that it works in regular and significantly larger-scale disposal than the pilot's scope. The aim is to dispose of an estimated 1–3 kilometres of shelves of material per year over the next five to ten years; the implementation model must therefore not only be very simple but also accurate and reliable. Some areas have already been identified that can only be developed and implemented after piloting. It is clear that a fully completed model cannot be created all at once; the process will be developed slightly using the Deming circle model (Plan – Do – Check – Act). It is essential to create a reliable system on top of which more functionalities and layers can be built in the future.

Disposal requires changes in key metadata systems and information systems of digitisation production. The changes that are to be implemented as part of the disposal pilot are briefly described below.

Disposal is built around the logic of archive series defined in a certain way. In the AHAA metadata system the archive structure is usually based on the traditional archive hierarchy levels (collection – series – archive units). However, documents related to the same archive in AHAA may have been transferred to the National Archives at different stages and at very different times. Before the digitisation can commence the metadata from AHAA must be transferred further to the Logistics application of mass digitisation which is a NAF in-house solution and serves as the central system for material management in digitisation. Disposal constitutes one of the logistical processing stages of logical data so the disposal will be guided mainly from the Logistics application. As the archive series and units in the AHAA system and the logistics application are therefore not completely identical there are risks associated with the exchange of information between them.¹¹ As part of the

¹¹ For example, an archive series may include several thousand archive units. Some of them may have been digitised earlier. Therefore, not the whole series but only the metadata of those units which have not yet been digitised will be transferred into the Logistics application.

development of the processing steps for disposal there will be a new metadata level created, the Release Batch that allows the documents to be processed in the form in which they were transferred to the National Archives, from the digitisation and all the way to disposal in future. In practice, after the National Archives has received and inspected the documents, information of the Release Batch (a Release Batch tag number) will be added to the documents using their unique ID information in the AHAA system. After this the data can be collected and transferred to digitisation systems quite easily and automatically.¹²

In the Logistics application disposal is controlled by the Disposal Batch entity and the desired Release Batches (one or more) can be tagged to the Disposal Batch. When the analogue documents are completely disposed of this stage will be recorded in the Logistics application. From there the information on the Release Batches included in the Disposal Batch will be sent to the AHAA system where information on the life-cycle event of disposal will be automatically recreated in the documents under the respective Release Batch ID and the analogue storage units linked to the documents will be deleted.

The permanent and up-to-date information on the documents – such as the fact that the unit only exists as a digital manifestation and its analogue manifestation has been destroyed – are thus in the AHAA system but the more detailed stages of the disposal itself and the actual control are included in the Logistics application. There are several processing stages for disposal where the documents to be destroyed are defined and assembled and where the documents are determined for different processing steps of disposal.

In general materials have several stages or ‘statuses’ in the Logistics application as soon as they are retrieved from the AHAA system. In the first stage, for example, the documents are marked with the status ‘Waiting in the repository’. Information is mainly updated on the basis of the barcode reading and partly by using automation. Once the digitisation is completed the documents have been validated and transferred to the SAPA system through automated processing and further to KP-PAS long-term preservation they go through the stages ‘Digitisation completed’ and ‘Returned to repository’ in the Logistics application. Once the contents of the documents have been checked again in the ASTIA system they will be transferred (as Release Batches) in the Logistics application to the ‘Retention period in progress’ tab. Here the documents can be viewed as a whole, showing which materials will

¹² For example, a transfer to NAF could include fifteen archive units to ten series in the collection which would have been created earlier in the AHAA and include other units dating to previous transfers. These fifteen units in ten series constitute the Release Batch which will be delivered to the Logistics application to be processed in digitisation and finally in the disposal stage.

be transferred to disposal. When the retention period expires the application automatically transfers the materials to the 'Ready for disposal' tab. Here, the materials can be transferred to disposal at the desired time.

Therefore, when the disposal is initiated a Disposal Batch will first be created in the Logistics application. Then all the needed Release Batches as well as the information of the premise from which the disposal takes place are tagged to the Disposal Batch. When these selections have been confirmed the application automatically transfers the materials to the 'Delivered for disposal' tab.

The steps described above take place solely at the information system level. When the documents have been checked to 'Delivered for disposal' their bar codes are also physically read in the storage facilities. This is to check that all units the system has collected for the Disposal Batch are actually found in the warehouse.

When the result of the barcode reading is 100%, meaning that all the units listed in the application and the barcodes read in the warehouse correspond to each other, the documents are automatically transferred to the tab 'Transport'. After this the archive units (or physical unit boxes) are stamped with the 'To be destroyed' stamp.

You can now choose the desired units for transport from the documents in the Transport tab. Of course, the number of transports depends on the material volume; typically about 100–200 metres of documents (or appr. 1250–2500 archival units) are transported for disposal at one time and transport continues until the selected release batches have been completely destroyed. Once all the materials have been checked to the 'Transport' tab, the respective disposal batch is automatically transferred to the 'Destroyed' tab.¹³

The 'Destroyed' tab lists all the Disposal Batches and the disposal entities within that have been delivered for disposal. The tab contains information on the Disposal Batches, Release Batches, metres of shelves in the Disposal Batch, the date and time when the last transport has been recorded as complete as well as the date and time when the Disposal Batch has been recorded as destroyed.

The Disposal Batch is recorded as destroyed manually when the National Archives has received a certificate of disposal from the disposal facility. After that the documents of the respective Disposal Batch can be recorded as destroyed from the drop-down menu intended for that purpose. The Logistics application sends the AHAA system a notification to delete the storage unit information (physical storage media) of the disposed materials as well as the information regarding the analogue manifestation. This will also update the data in the ASTIA system where the docu-

¹³ The application also has a hidden intermediate stage between Transport and Destroyed for monitoring the material's progress during transport.

ments can be consulted – available only in digital format from then on. The AHAA system is also connected to the National Archive's storage management system (AHJ) from which the facilities so far reserved for Disposal Batches are released for other uses and are added to the amount of empty shelf space after the disposal of the documents.

To summarise, the stages of disposal have been modelled very accurately but the stages progress clearly and logically and can be used easily in the Logistics application guiding the disposal. Importantly, all processing steps are verifiable and always apply to the entire Disposal Batch, that is, one or more Disposal Batches, and never to individual archive units. The commands to move from one stage to the next are manual but the information is updated collectively and automatically (individual series or other hierarchical levels do not need to be clicked, selected or opened).

The physical method of disposal of the materials will most likely be incineration and further use as an energy source. The same monitoring model based on barcodes as is used in the information system will be applied as much as possible also in logistics; trolleys or other means of transport by which the materials are transported to disposal will also be bar-coded and the materials will be included in them. Likewise at the incineration plant, the materials can still be registered for actual disposal, which can also verify that the transport has delivered them as planned.

The piloting of the disposal itself will be carried out in three to four stages. First, we ensure the functionality of the changes made to the systems. The disposal is therefore simulated with a database duplicated (cloned) for this purpose, which is used to practise the disposal without transferring or reading the barcodes of the actual materials. Thanks to cloning disposal can be tested in a real production environment without disrupting the actual simultaneous digitisation production. If everything goes according to plan and no disturbances occur the first Disposal Batch is disposed of with a single Release Batch. The first stage also models different ways to calculate and place archiving units in the means of transport in the best possible way.¹⁴ In the next stage the Disposal Batch is assembled from different Release Batches where the system's ability to manage the compilation of data from different materials into one Disposal Batch is tested in the real environment, with several transports also carried out. In the third stage disposal is carried out with a different transport model and the size of the Disposal Batch is increased so that it includes several Release Batches and is carried out in several different transports. In a possible fourth phase material monitoring will be introduced during transport and at the disposal facility.

¹⁴ The storage warehouse from which the materials to be disposed of are collected only stores materials that have already been digitised and which are to be destroyed after the digitisation.

After the pilot we will assess the need for further development, specify the risk assessment and immediately start to model the additional measures required for regular disposal. The significant increase in volumes should mean at least more specific solutions for the implementation of transport and processing of physical materials (for example, intermediate storage of materials waiting for disposal transport).

4 Conclusion Remarks

In conclusion, the National Archives is enthusiastic but also aware of its responsibilities and risks regarding the launching of the disposal process. As with all handling of documents (in this case containing a large amount of personal data) there are risks, which have been estimated, and we will continue to analyse and specify them after the pilot as well. However, the starting point and foundation of everything is high-quality digitisation – that the documents truly exist in a reliable digital format of good quality. Another important part is to design the information system that directs the disposal so that the number of human errors is as minimal as possible – nothing can happen ‘accidentally’ and the number of stages, measures and information to be monitored is moderate. Of course, the use of the system requires good and sufficiently long training – disposal will probably be one of the few stages of digitisation that cannot be carried out by all operators but rather only by persons trained and authorised to do so. The third important element is to ensure the data protection of disposal. It is also the only stage of disposal for which the National Archives is not solely responsible but due to more operators its risks are also greater.

NAF will move on from the disposal pilot to actual regular disposal only after it has been ensured that everything works. We in the NAF believe that the launch of disposal as the last step of the digitisation process aimed at disposal will further increase the interest of the authorities and other organisations in obtaining the digitisation services of the National Archives.

Oliver Hahn, Carsten Wintermann and Uwe Golle

Multispectral Analysis of Paper Objects – The Amalgamation of Archaeometry and Conservation

Abstract: This paper is dedicated to the material science analysis of drawings using imaging techniques commonly referred to as multispectral analysis. Multispectral here means examination with electromagnetic radiation from the range of UV, visible and NIR light. Radiation diagnostics are extended by the use of X-ray fluorescence analysis which uses distribution images to depict the spatial arrangement of characteristic elements on the drawing surface. Such analyses not only provide general insights into the type and composition of the materials used; in the field of drawing research insights into the genesis of the work can be gained by locating preliminary drawings, determining revisions and corrections, while sometimes it is also possible to draw conclusions about the provenance of the pencils, crayons or inks used on the basis of characteristic trace elements. Furthermore, multispectral analysis provides essential insights when examining palimpsests in order to make erased or deleted parts visible. The determination of the colorants possibly allows dating and thus enables the detection of later copies or even forgeries. The non-invasive examinations provide a comprehensive insight into the materiality of paper objects and thus form the basis for the development of sustainable conservation and restoration campaigns.

1 Introduction

Drawing has been established as an independent art genre alongside painting since the early modern period. Drawings are not only a sketch or draft but also a work of art in their own right. As with paintings, questions of original, copy, or replica can be answered not only by cultural-historical but also material-scientific investigations. In his standard work on drawing analysis Joseph Meder points out the impor-

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tance for interpretation of knowing the materials used in drawings and emphasises the scope and versatility of the drawing materials used.¹

In this article the primary question to be addressed is to what extent material-scientific investigations can contribute to – more art-scientific – connoisseurship.² Knowledge of art history and methods of material science combined will possibly constitute a higher level of connoisseurship. It is undisputed that materials – including drawing materials – change over time. As early as the late eighteenth century the colour change in iron gall inks was pointed out: inks with too much iron vitriol turn yellow to red while the more stable inks mixed with too many gallstones soon turn brown.³ It can therefore be assumed that the originally black iron gall inks have only partially retained their original colour and have browned. Damage caused by ink corrosion or wood pulp paper is far more serious – here, material analysis plays an important role in preserving the cultural heritage.

2 Methods

Dating and proving the authenticity of a work are classic questions addressed to material analysis. If the substrate is paper analysis of the watermarks (Figure 1) and documentation of the paper structure are essential starting points for a temporal and spatial classification of the medium which in turn provides clues for dating or

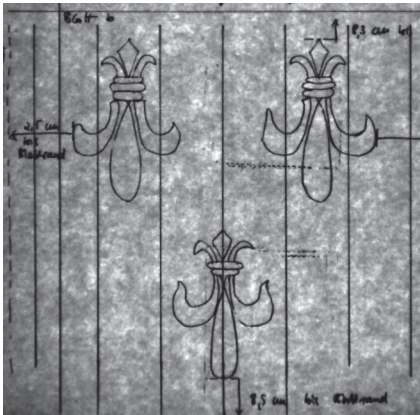


Fig. 1: Characteristic watermarks from Germany, three fleurs-de-lis without further designation, Joh. Michael Stoß (1738–1821), Arnstadt, paper mill. Watermark Collection DNB/DBSM/WZ, reference number DE4815-DNB-L-WZ-0000523-wm1. Image: German National Library

1 Meder 1919, 33.

2 Ketelsen and Hahn 2022, 289.

3 Ribeaucourt 1797, 28.

attribution to an artist or workshop.⁴ Whereas in the past, until the 1980s, elaborate stationary procedures were used to reveal watermarks⁵ today a diverse and variable set of instruments is available that allows not only watermarks but also the structure of the paper to be digitised and thus made available for comparative research.⁶

Characterising the drawing materials used is far more complex. In addition to questions of age and authenticity the focus here is more on explaining the genesis of a drawing. How and with what material was the drawing or copy made? What ink was used for the final drawing? Can revisions, corrections, or possible later revisions be made visible? Can connections be drawn between the drawing and possible inscriptions? For a first approach to these questions looking through a microscope to classify the materials is very helpful – but an exact material characterisation cannot be done with the naked eye.⁷ Detecting trace elements, which provide clues to the provenance of a mineral drawing material (Figure 2),⁸ and determining minor components in iron gall inks enabling the differentiation of the inks by determining the so-called fingerprint (Figure 3)⁹ require more elaborate material-scientific examinations. Finally, there are imaging methods which are becoming increasingly important. These methods, nowadays referred to as multispectral imaging analysis (MSI), are derived from infrared reflectography (IRR) which was developed in the 1960s to reveal preliminary drawings¹⁰ and are increasingly becoming part of today's archaeometric and restorative research due to their diverse analytical possibilities in combination with effort and costs.

Most of the analytical procedures can be summarised under the term radiodiagnostic examinations. In such procedures light of a certain wavelength or energy interacts with the matter to be examined. In this process, known as excitation, portions of energy are transferred,¹¹ orders are briefly disturbed and individual particles are removed from groups. The interaction depends on the type of excitation light – visible (VIS), ultraviolet (UV), infrared (IR), lasers of different wavelength excitation (Raman), or X-ray light (X-Ray) – and the structure or composition of the material under investigation. After a short disturbance the system returns to its

4 Dietz 2011, 281.

5 Schoonover 1987, 154.

6 Dietz and Wintermann 2015, 19.

7 Wintermann and Melzer 2022, 156.

8 Nöller 2012, 61.

9 Malzer et al. 2004, 229.

10 Asperen de Boer 1972.

11 In most cases, this energy transfer occurs from the exciting light to the material under investigation.

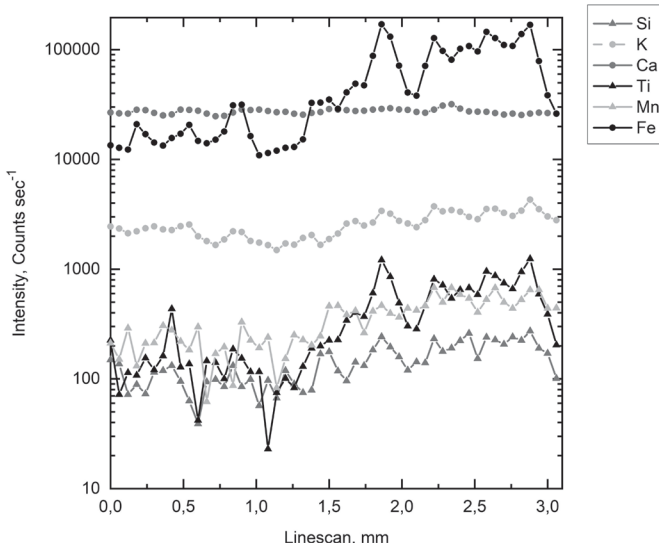


Fig. 2: Element scan of red chalk on paper carried out on a line by means of X-ray fluorescence analysis. From the element courses it can be concluded that red chalk not only contains the main component iron (Fe), but also other components such as silicon (Si), potassium (K), titanium (Ti) and manganese (Mn), which correlate with the iron. Only the course of calcium (Ca) is constant – it derives from the paper. Image: Federal Institute for Materials Research and Testing

original ground state. This relaxation process leads to the release of characteristic radiation which, interpreted as a spectrum, provides information about the type and composition of the material. In this context the term spectroscopy still needs to be explained: it refers to scientific procedures that differentiate radiation according to a certain property.¹²

Many of the radiation diagnostic examination methods are named after the type of excitation radiation used. In this article we will not describe all methods in detail.¹³ Only X-ray fluorescence analysis, infrared reflectography and Raman spectroscopy will be briefly touched upon here since these methods are indispensable as basic technologies in the material-scientific analysis of written material and graphics. It should be particularly emphasised in this context that these methods are non-invasive, i. e. non-destructive, methods of analysis that do not require the removal of samples.

¹² These properties include wavelength or energy.

¹³ Detailed descriptions can be found, for example, on infrared spectroscopy in diffuse reflection in Steger et al. 2018, 103 and on Raman spectroscopy in Centeno 2016, 9.

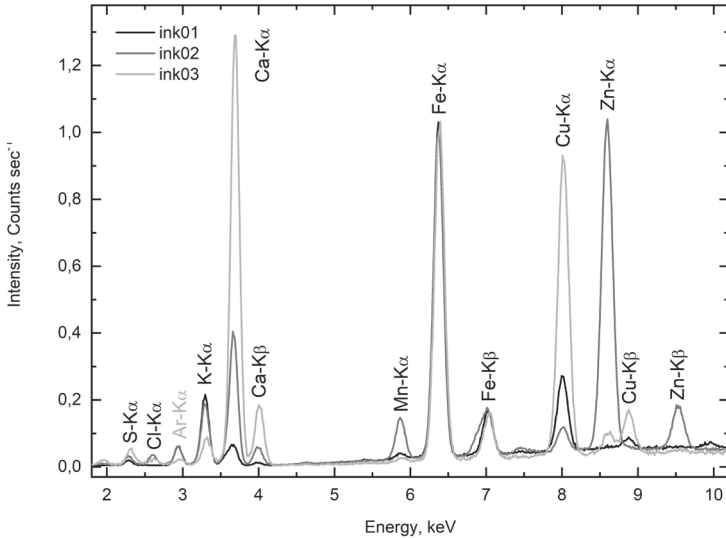


Fig. 3: X-ray fluorescence analysis of three iron gall inks with different compositions. Besides the main component iron (Fe), other components such as potassium (K), manganese (Mn), copper (Cu) and zinc (Zn) can be detected. The element calcium (Ca) results from the paper substrate. Image: Federal Institute for Materials Research and Testing

2.1 X-Ray Fluorescence Analysis (XRF)

X-ray fluorescence analysis is one of the standard methods for determining elemental compositions and is an integral part of archaeometric investigations.¹⁴ The material to be examined is irradiated with X-rays. Due to the interaction between X-ray light and matter, individual electrons are knocked out of their original environment in the atom. The atoms, excited in this way, return to their ground state while emitting X-ray light, with electrons from shells further filling out the hole created. This relaxation process is associated with the emission of characteristic radiation because each atom has a special electron configuration – i. e. a structure of its electron shells. The height of the X-ray peaks generally obtained allows conclusions to be drawn about the quantity of the element contained.¹⁵ Usually the examinations are carried out as individual measurements or line scans. An X-ray fluorescence portal scanner enables an entire drawing in the area to be analysed.

¹⁴ Bronk et al. 2001, 307.

¹⁵ Hahn-Weinheimer et al. 1995, 70.

To perform the XRF scans presented here the Jet Stream from Bruker Nano GmbH with a rhodium X-ray tube was used. During the scan the measuring head containing the excitation tube (Rh, 50 kV, 0.6 mA) and the detector (Xflash™ detector) is moved over the object at high speed (diameter of the excitation beam: 50 μm , step size: 25 μm ; measuring time: 2 ms per measuring point). A complete mapping of the elements within the different drawing sections is obtained. The device is designed to measure in air. The penetration depth of the radiation is between 10^{-6} and 10^{-1}cm depending on the matrix.

2.2 Raman Spectroscopy (Raman)

For the chemical analysis of many organic and inorganic materials Raman spectroscopy has been a common method alongside infrared spectroscopy for years. In contrast to investigation methods for element-specific characterisation, vibrational spectroscopy exploits the effect of electromagnetic radiation on atomic bonds.

If molecules are irradiated with monochromatic light (e. g. laser light) the irradiated light is scattered. This scattering is based on a transfer of energy from irradiated light to the molecules and molecular lattices, which are always vibrating, or the reverse process.

After decomposition of the scattered light additional spectral lines appear next to the intense spectral line of the primary beam of the light source which are shifted with respect to the frequency of the light source. The latter lines are called Raman lines. Raman spectroscopy is used in particular for the investigation of minerals and pigments.

The investigations were carried out with a Raman spectrometer from Renishaw. The instrument was specially designed for archaeometric applications and is equipped with glass fibre optics. The excitation is done with a laser of 785 nm wavelength. The spectral range is 3600 to 100 cm^{-1} . The maximum spectral resolution is 4 cm^{-1} .¹⁶

2.3 Infrared Reflectography (IRR)

Infrared reflectography, which was first used to examine paintings in the 1960s, is based on the characteristic interaction between infrared light and the object to be examined. The object is irradiated with infrared light (IR) and an infrared-sensitive

16 Centeno 2016, 9.

camera captures an image of the radiation not visible to the human eye. The substances absorb the IR light in a way that is characteristic of their chemical composition. Substances containing elemental carbon appear black in the IR image while other materials – for example colourants – appear transparent. With this method preliminary drawings in paintings can be successfully made visible again if they were executed in charcoal or black chalk.

The method was further developed by the introduction of band-pass filters which split the infrared light into defined sub-areas. The band-pass filters are placed in front of the infrared camera so that it always detects only a discrete section of the IR light. A continuous change of the band-pass filter allows a much more detailed determination of the absorption behaviour. This makes it possible to clearly differentiate between different writing and drawing materials such as soot inks, iron gall inks and plant inks.¹⁷ Further diversification within a type of writing material is possible only to a limited extent with this method since processes that have occurred in the course of the transmission – such as restorations – falsify the picture.¹⁸

Infrared reflectography and the band-pass filter infrared reflectography that emerged from it are fundamental for the development of multispectral analysis, which extends the range of excitation light beyond the visible light to UV light.

3 Case Studies

As already mentioned at the beginning of this chapter, the result of the scientific analysis is based on the interaction – the interplay – between stimulating light and illuminated material. And so the comparison of the two sheets *Rebecca and Eliezer at the Well* (c. 1640), originally attributed to Rembrandt (1606–1669), and *The Old Man Reading* (c. 1630–1631) by Ferdinand Bol (1660–1680) shows the influence of materiality on the visualisation of preliminary drawings or underdrawings. The material-scientific characterisation of the drawing *The Levite and the Dead Concubine* (c. 1650–1652) provides information about corrections and revisions that the drawing has undergone. Furthermore, examining the two drawings *Handing of the Keys to Peter* and *The Striding Male Figure* makes it possible to distinguish between charcoal and mineral chalk. The possibilities of colour analysis will be explained using the example of two compositions by Andor Weininger (1899–1986).

¹⁷ Mrusek et al. 1995, 68.

¹⁸ Different quantities of one and the same prescribed material as well as different paper substrates can also lead to a misinterpretation of the results. Here, further investigations are necessary, such as the already mentioned element analysis using the fingerprint model.



Fig. 4: *Rebecca and Eliezer at the Fountain*. Copy after Rembrandt Harmenszoon van Rijn? Klassik Stiftung Weimar, Graphische Sammlungen, Inv. no. KK 5511, ID 447184. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

3.1 Recovery of Underdrawings

The first sheet shows *Rebecca and Eliezer at the Fountain*, originally attributed to Rembrandt (Figure 4). The brown-toned colour impression suggests that the drawing was executed with iron gall ink. A more precise visual analysis with the microscope reveals indications of a very precise preliminary drawing, which was obviously executed with a dry drawing material. The comparison of the infrared reflectography (Figure 5) with the original drawing illustrates the accuracy of the preliminary drawing; even the contours of the broad ink strokes are pre-drawn. Infrared reflectography cannot differentiate whether this is charcoal which consists solely of pure carbon or, for example, stone chalk which contains additional mineral components;¹⁹ an elemental analysis is necessary here.²⁰ However, the analysis

¹⁹ At this point it should be noted that a microscopic observation could be used to differentiate. The sharp-edged mineral components can produce scratch marks in the abrasion of the stone chalk; these are missing in the stroke of the charcoal.

²⁰ Further analysis using X-ray fluorescence analysis suggests bone black.



Fig. 5: *Rebecca and Eliezer at the Fountain*. The carbonaceous preparatory material is clearly visible in infrared reflectography, while the overlying iron gall ink disappears. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

suggests that this is a copy that has been transferred with the carbon-containing pigment.

In the case of the *Reading Old Man* by Ferdinand Bol (Figure 6) it is quite the contrary.²¹ The naked-eye view shows that in the area of the head, especially in the beard and on the back of the old man, a sketchy pen drawing was executed with light brown ink. Most of the drawing – the face, the coat and the book the old man is reading as well as the chair and the stone wall in the background – was executed with a brush in grey and black. In addition, there are ornamental details in red chalk and revisions in opaque white. The exact interplay of pen and brush, i. e. preliminary drawing, execution and final reworking, is not clearly discernible at first.²²

Only through material analysis does the genesis of the sheet become understandable. For example, X-ray fluorescence analysis which was carried out as an element scan and makes its distributions on the sheet visible clearly shows a prelim-

²¹ Ketelsen et al. 2021, 498.

²² Hahn 2022a, 117.



Fig. 6: *Reading Old Man*, Ferdinand Bol, c. 1630–1631, pen and brown ink, brush and grey and black ink, red chalk, opaque white. Klassik Stiftung Weimar, Graphische Sammlungen, Inv. KK 5496, ID 502508. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

inary drawing in iron gall ink: the underdrawing for the entire work (Figure 7). The spatial heterogeneity of the preparatory drawing which gives an indication of the templates used for the motif will not be discussed here.²³ This preparatory drawing could not have been made visible with infrared reflectography since substantial parts of the drawing were executed with carbonaceous pigments that overlay the preparatory drawing in iron gall ink.

²³ Ketelsen et al. 2021, 499.



Fig. 7: *Reading Old Man*. The element distribution of iron (Fe) determined with an X-ray fluorescence scanner indicates a signature with an iron-containing material, iron gall ink. Image: Klassik Stiftung Weimar, Graphische Sammlungen, graphics: Uwe Golle

The two case studies concerning the visualisation of preparatory drawings document impressively that there is no universal method for a specific question from the field of connoisseurship that can be applied in principle. This may sound trivial at first but it is a significant fact. The diversity of drawing materials – soot inks and iron gall inks, metal, graphite and coloured pencils, charcoal and crayons, as well as inorganic pigments and organic dyes – requires an equal diversity of material science methods. Only the interaction of the individual findings provides the overall context of the drawing.



Fig. 8: *The Levite and the Dead Concubine*, originally attributed to Rembrandt Harmenszoon van Rijn, c. 1650–1652, Klassik Stiftung Weimar, Graphische Sammlungen, Inv. no. KK 5497, ID 502523. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

3.2 Corrections and Pentimenti

The drawing *The Levite and the Dead Concubine* (Figure 8), previously attributed to Rembrandt, has several corrections whose design poses a mystery. First, the analysis of the drawing inks revealed an iron gall ink in two different concentrations. With the first ink, whose appearance is now light brown, the centrally positioned donkey and the four figures were outlined with a narrow pen and joined together to form an overall composition. In the original arrangement the donkey's head faced the old man standing under an arched doorway. The donkey's head facing inwards was then painted over with white lead. This can clearly be seen in the corresponding element distribution picture (Figure 9). Later on, the donkey's head was changed with a broad pen and brush using the same iron gall ink in a stronger concentration,



Fig. 9: *The Levite and the Dead Concubine*, elemental distributions of iron (Fe) and lead (Pb). Image: Klassik Stiftung Weimar, Graphische Sammlungen, graphics: Carsten Wintermann

which has a darker effect. The iron gall ink was mixed with the opaque lead white here; this resulted in the darker appearance of the ink visible today. With the same second ink further corrections were made to the drawing. Furthermore, a second white pigment that is not lead white was also used for corrections which probably originates from a later retouching. The framing of the sheet was also done later. The reconstruction of the individual work steps suggests that the original arrangement on the sheet was changed. The question arises whether this sheet is a workshop drawing.²⁴

²⁴ For a detailed discussion of this topic, see Ketelsen et al. 2022, 503.



Fig. 10: (left) detail *Handing of the Keys to Peter*, Städel Museum, Frankfurt, Inv. n. 7063. Image: Städel Museum; (right) detail *Striding Male Figure*, Kupferstich-Kabinett, SKD, Inv. no. Ca19BI26. Image: Kupferstich-Kabinett der Staatlichen Kunstsammlungen Dresden

3.3 Material Analysis of Black Drawings

As already indicated, infrared reflectography or multispectral analysis can be used to distinguish carbon-based drawing materials such as soot, charcoal, graphite, or natural chalk from other drawing materials, but further distinctions are not possible. Based on two drawings, the *Handing of the Keys to Peter* from the Städel Museum in Frankfurt and the *Striding Male Figure* from the Kupferstichkabinett in Dresden, X-ray fluorescence analysis will be used to make such a differentiation (Figure 10).

Figure 11 shows the respective X-ray fluorescence spectra of the black drawing material of the handing over of the key and the striding man. In addition, comparative spectra of the respective papers are included to estimate the influence of the background on the elemental analysis of the drawing material. It becomes clear that in the *Handing of the Keys to Peter* the spectrum of the black drawing material and the corresponding reference spectrum are identical which means that it is a purely organic drawing material. In the *Striding Male Figure*, however, additional peaks appear for the elements aluminium (Al), silicon (Si), potassium (K) and titanium (Ti). In addition, the peak for iron (Fe) is clearly elevated. The

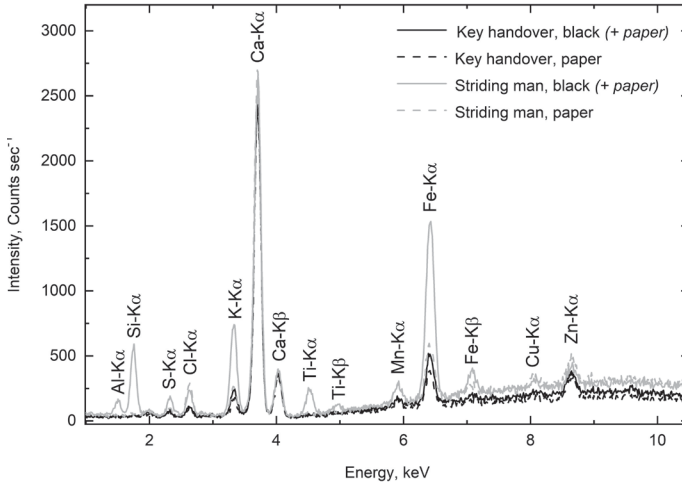


Fig. 11: X-ray fluorescence spectra of the black drawing material of the *Handing of the Keys to Peter* and the *Striding Male Figure*. In addition, comparative spectra of the respective papers are included to estimate the influence of the background on the elemental analysis of the drawing material. Image: Federal Institute for Materials Research and Testing

elements indicate mineral components: in the case of the striding one, the drawing material is stone chalk, i. e. clay slate, or alumina coloured with carbon. The material, which contains the silicate components common to clay, is found in deposits all over Europe.

3.4 Investigation of Colourants

The question of copy or original arises particularly in the case of artists or workshops that were active over a long period. In the Bauhaus holdings of the Klassik Stiftung Weimar [Foundation of Weimar Classics], there are several pairs of sheets with clear motivic similarities; here it can be assumed that one drawing was created at the time of the Bauhaus, while the other is to be regarded as a copy of the original by the same artist. As an example, two compositions by Andor Weininger are discussed here.²⁵ Weininger began his studies in Weimar in 1921 and devoted himself to various techniques and genres during his time as a student, developing a particular affinity for theatre. In 1968, Weininger participated in the

²⁵ Wintermann 2022, 64.

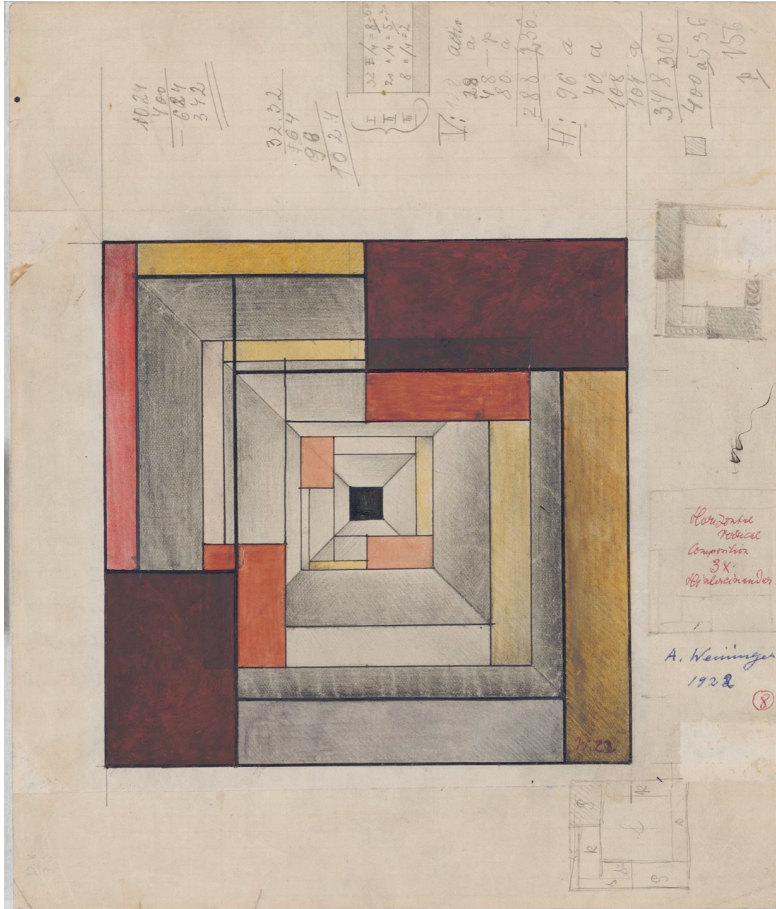


Fig. 12: Andor Weinger, *Horizontal-Vertical-Composition*, 1922, pen and black ink, watercolour, gouache and graphite on painted yellowish cardboard. Klassik Stiftung Weimar, Graphic Collections, Inv. no.: KK 11591, ID 503493. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

first post-war exhibition ‘50 Years of the Bauhaus at the Württembergischer Kunstverein’ with a theatre design from 1921, the *Kugel-Theater-Projekt*. From the 1950s onwards numerous self-replicas based on early sketches are also known from the Bauhaus period.

The drawing *Horizontal-Vertical-Composition* from 1922 (Figure 12) has numerous notes and corrections and thus provides a deep insight into Weinger’s work genesis and procedure. Changes such as the covering of the upper reddish rectangle by the brown rectangle illustrate the searching creative process. The sheet is

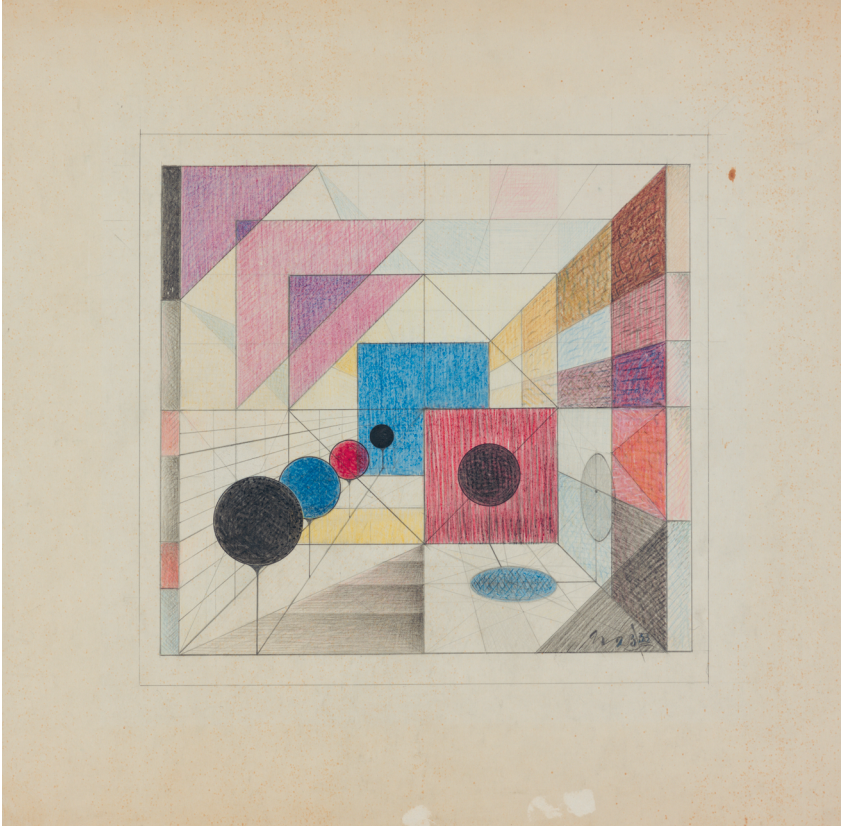


Fig. 13: Andor Weinger, *Stage Design*, 1953 (1923), pen and ink in black, graphite, coloured chalks on light green cardboard. Klassik Stiftung Weimar, Graphische Sammlungen, Inv. no.: KK 11557, ID 504368. Image: Klassik Stiftung Weimar, Graphische Sammlungen, photo: Carsten Wintermann

already securely dated with regard to its provenance so that the material-analytical examinations support this claim to authenticity. At the same time, however, they allow conclusions to be drawn about the drawing materials used at the newly founded art school.

The *Stage Design* from 1953 (Figure 13) shows a work in the constructive style of the early Bauhaus years. In contrast to the *Horizontal-Vertical Composition* there are no changes or notes. Both sheets have a very similar, remarkably conventional pigment palette for both 1922 and 1953. In the *Stage Design*, however, an additional clear marker for a time of origin after 1935 could be proven with phthalocyanine blue (Figure 14), thus verifying the date of origin of 1953. The question why Weinger used traditional colourants and not the latest prepara-

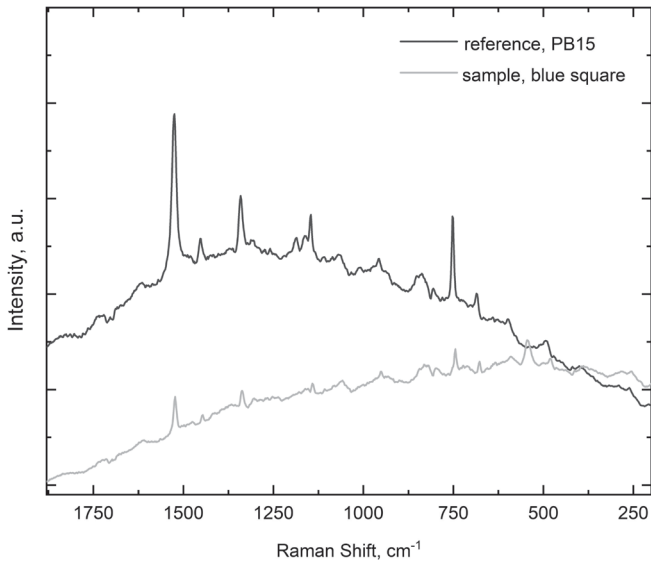


Fig. 14: Raman spectrum of the medium blue square in the *Stage Design*. The comparison with the reference database clearly shows that the blue colourant is phthalocyanine blue (PB15). Image: Federal Institute for Materials Research and Testing

tions can be answered only in the context of a more comprehensive study of the Bauhaus.²⁶

4 Conclusion

Even though material analysis – as described here – now offers a variety of approaches to drawing research many publications on the subject do not take it into account. Art historical connoisseurship still relies on comparative stylistic analysis; there is no consideration of the papers used or the drawing materials. One of the reasons for this approach may be the effort required for a careful analysis.

However, the findings from the archaeometric examinations always provide insights into the state of preservation of drawings or even manuscripts. The comparability of these two genres results from the similarity of the materials which were used. The supporting medium is usually parchment or paper; the writing and

²⁶ Hahn 2022b, 31.

drawing materials are essentially iron gall inks as well as soot inks and more rarely graphite and lead pencils. Damage caused by mould, iron gall ink corrosion and copper corrosion or the fading of writing and drawings have been reported in many publications.²⁷

In this way they provide important clues into whether and to what extent conservation interventions are necessary; they generate parameters for planning exhibitions and thus they enable the permanent preservation of cultural heritage.

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²⁷ Reißland 1999, 167.

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IV Sustainability and Resource Management

Chris Woods

Sustainable Conservation of Collections – The Push for Passive

Abstract: This paper reviews how archives and books have been stored in recent decades, identifies the weaknesses of common principles and practice applied to storage involving mechanical air conditioning systems and aims to define ‘sustainable conservation storage’. It encompasses the experiences of the author and contemporary conservators, archivists and librarians and attempts to explain why heating, ventilation and air conditioning (HVAC) control happened, why it has been wasteful and unsuitable for such storage and what form of storage archival collections really need in order to be conserved. It directs the reader towards new standards and codes that are now promoting passive climate storage wherever possible and to explore reducing or ceasing to use HVAC systems for managing storage climates. Above all, it urges custodians everywhere to reduce reliance on such equipment and thereby reduce risk to collections, reduce energy use, remove or reduce the costs of installation and maintenance of mechanical systems and reduce carbon emissions.

Conserve:

to keep and protect something from damage, change, or waste:

- To conserve electricity, we are cutting down on our heating.
- In order to conserve fuel, they put in extra insulation.¹

Since at least the time of BS 5454:1977 the first British Standard covering storage of documents, environmental control in the United Kingdom and many other nations’ archives and libraries has involved using heating, ventilation and air conditioning systems (HVAC) to stabilise and manage internal climates.² Standards and specifications from that time were an attempt to control environments in otherwise unsuitable rooms in existing buildings, being commonly the only spaces available for growing collections. These earlier spaces were often not designed for the storage

¹ Cambridge Dictionary online, <<https://dictionary.cambridge.org/dictionary/english/conserv>> (last accessed 23 April 2024).

² BS 5454:1977.

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of collections which need to remain moderately cool, dry and free from the risk of mould and pests. Many spaces were damp and traversed by pipework for water and heating serving other rooms. It is perhaps notable that the popular conception of storing records in damp and unsuitable spaces is by no means a twentieth-century phenomenon. Witness for example Charles Dickens, writing in 1859 in his novel *A Tale of Two Cities*: 'Your deeds got into extemporised strong-rooms made of kitchens and sculleries, and fretted all the fat out of their parchments into the banking-house air'.³

We may wish to gloss over the fact that the processing of sheep skins into parchment specifically involves the removal of fats: Dickens' understanding of the effects is misdirected. Nonetheless, the insight he provides is that storing records in bulk has for many generations involved placing them in any available space, however unsuitable for their long term conservation. He used the term 'strong-room', perhaps revealing a common notion that security from theft or disassociation was foremost in the custodian's mind and that at least at that time the properties of the material stored and what they needed to survive intact were not understood. These strongrooms were described as 'extemporised', by which one must infer that the records were taking up too much space elsewhere and whatever space could be found would be used instead for storage, without recognising whether or not those new spaces were going to conserve the records.

This author is by no means alone in having spent a career working in archives and libraries where collections were, have been and in too many instances still are stored in 'extemporised' spaces instead of purpose-designed constructions. It is clear from reading BS 5454:1977, the standard's first iteration, that there was a determination that ideally stores for archives should be purpose-designed but also a recognition that this could not universally be applied, especially given the diversity of locations (buildings) already used for archive storage. The standard sought to define what a new 'archive repository' should be like and determined that these characteristics should be attempted if possible in existing stores. The Foreword of the publication asserts:

Although these recommendations have been made as specific and comprehensible as possible, the committee responsible for drafting them is well aware that some questions require more detailed and specialized advice for their solution, that many can be fully answered only in the context of local conditions and that to others no entirely satisfactory answer has yet been found.⁴

³ Dickens 1859, 34.

⁴ BS 5454:1977, Foreword paragraph three.

The last words in this paragraph may be read as an acknowledgement that, for example, the costs associated with creating a suitable store may not be affordable. It could be read as an admission that the state of knowledge of the topic was not sufficient at that time to provide clearer direction as to the material needs of archival collections. The preceding paragraph states:

These recommendations are based on the nature of the records or archives that will form the bulk of the repository's contents. These records or archives may be in the traditional media, such as parchment, paper or printed books, or photographic or electronic media.⁵

However, the standard does not directly define what this 'nature' is, only what causes damage to archives. One is left to read between the lines in the body of the standards that the media are hygroscopic, i. e. that they can absorb water when in a damp environment and will also release it again in a drier environment (their reference to electronic media was magnetic tape, the binders of which are hygroscopic even if the tape itself may not be). The primary medium for water in this context is atmospheric, in the air surrounding the archives, though clearly the drafters of the standard were also thinking of risks associated with direct contact of liquid water by leaks, penetration and flooding: 'Basement accommodation where water may accumulate is unacceptable'.⁶ The primary focus on environmental protection in the standard is temperature and relative humidity (RH) and from the outset the expectation is that suitable conditions are only achieved by the use of air conditioning, though at that time 'air conditioning' was largely only air temperature control. In addition to several sub-clauses in clause 7 on fire protection relating to the installation of air conditioning systems and ductwork, see for example:

5.7 Air conditioning. The design of the repository should take account of the need for full air conditioning (see clause 9).⁷

Clause 9 focuses on 'Climatic conditions', asserting that unfavourable atmospheric conditions 'have damaged documents more extensively than any other single factor'.⁸ The only solution to this particular risk is defined as the installation of air conditioning systems:

⁵ BS 5454:1977, Foreword paragraph two.

⁶ BS 5454:1977, Clause 5.1.

⁷ BS 5454:1977, Clause 5.7.

⁸ BS 5454:1977, Clause 9, 9.1 Introduction.

Careful control and observation of temperature, humidity and ventilation within the repository and regular expert maintenance of the necessary plant is therefore essential.⁹

Subsequent clauses include definitions of the parameters deemed necessary for each of these three features: temperature, humidity and ventilation. Ventilation is considered a climatic feature itself and defined as requiring the air to be in ‘continuous motion day and night, being recirculated to all parts of the repository six times an hour, with a 10% intake of fresh air’.¹⁰

No reason is given in this 1977 standard for the need for this level of circulation and fresh air ventilation. Later iterations of the standard (1989 and 2000) make reference to air conditioning that ‘eliminates pockets of stagnant air’ and that shelves must be adequately ventilated ‘to allow the free movement of air and prevent the build-up of pockets of high relative humidity’.¹¹

Although by the 2000 iteration there is express recognition that air tightness and thermal insulation or mass (in the form of ‘high thermal inertia’) are important and that there is ‘Greater emphasis on [...] provision of stable environments [...] with minimal mechanical intervention’, more reasons are given to justify fresh air ventilation.¹² Clause 7.4 Ventilation asserts that:

The air within the repository should not be stagnant. There should be sufficient air movement to avoid pockets of stagnant air.¹³

For the first time a note is added making the bald assertion that, ‘Air movement removes off-gassing of organic materials and prevents build-up of high relative humidity,’ with no reference to any source that might back up the assumption that any off-gassing of these materials presents a risk to themselves (and equally failing to observe that the same standard recommends in extensive detail the enclosure of these materials in sleeves, folders and boxes, apparently leaving them to cook in an unspecified soup of their own juices).¹⁴ One type of archive material alone, cellulose acetate, in the form of sheet film (negatives and transparencies), cine film and earlier reel-to-reel audio tape, can exist in archives in sufficient quantity to represent an internal pollutant risk, emitting as it does acetic acid as it decays over time. However, as a format it tends to be the target of projects to separate it from

⁹ BS 5454:1977, Clause 9, 9.1 Introduction.

¹⁰ BS 5454:1977, Clause 9.3.

¹¹ BS 5454:1989, Clauses 7.2 and 9.7.

¹² BS 5454:2000, Foreword.

¹³ BS 5454:2000, Clause 7.4.

¹⁴ BS 5454:2000, Clause, 7.4.1.

archives and provide different storage. Failure to recognise the inevitable and rapid deterioration of acetate has led to the decay and inaccessibility of negative collections; finally, BS 4971:2017, the new standard that inherited the conservation management elements of the old BS 5454, set out the requirement to separate and freeze this material as it will not last in temperatures above zero centigrade.¹⁵ The clauses on this material in the old 5454 standards do not identify this material as an internal pollutant risk, however, so the perception of hazards associated with decay of archive materials are at best non-specific.¹⁶

Even if the drafters did know that only acetated plastics were the subject of their concerns about internal off-gassing (there is no evidence of this specificity), to propose running fresh air ventilation and constant cooling and dehumidification for an entire traditional archive collection solely for the purpose of attempting to manage the behaviour of one modern and minority format has since been recognised as inappropriate. Furthermore, since the temperatures recommended in those earlier standards were not going to conserve this material anyway, the approach may be seen in hindsight as wasteful and misinformed. Nonetheless, the notion of deleterious off-gassing and the need for fresh air in archives gained common currency and in this author's experience continues to be recalled by older engineers as justification for constant ventilation.

Retrospectively reviewing these standards implies that the lived experience of archivists and librarians included the use of stores that had sources of uncontrolled water or moisture and the only means conceived of overcoming this problem was by changing the qualities of the air in the store. Certainly in the UK this continues to be the situation for many archives. Reference to build-up of high RH does not identify the real sources of such water; it assumes moisture will continue to be input into a store even if there is no source. RH is a measurement, not an object: it requires input of water to stay consistently high. A waterproof structure with a high level of air tightness and with no additional internal sources of water will not change its moisture content significantly: there is no water input except tiny quantities in infiltrating air when it is at a sufficiently high moisture content. Nonetheless the fear of RH measurements has been commonplace.

An electronic humidity sensor sitting in an open place in a room where the temperature changes rapidly will automatically recalculate the RH of the air. RH in such a sensor is a mathematical calculation based on the moisture available in the air when the air is at a specific temperature. If the temperature suddenly changes it will recalculate and show a higher or lower RH but the actual weight of moisture in the

15 BS 4971:2017, Clause 5.1.4.2.

16 Ligerink and Di Pietro 2018.

room will not have changed. This simple fact is behind some of the misconceptions of what constitutes suitable storage and in its way may have led to the promotion of using HVAC equipment to control the temperature and moisture content of the air that it circulates. Witnessing a momentary increase in measured RH of air in a room has caused custodians to fear that their collection will rapidly grow mould but the reality of this process has been misunderstood and the solution was perceived to be air movement.

Air movement alone does not prevent mould from germinating. The germination of mould is reliant on a source of nutrition (such as a parchment document or a leather book cover etc.), a significant moisture content in that substrate (e. g. caused by liquid water or by the absorption of atmospheric water vapour over time) and a stable high RH in the air surrounding that substrate. Germination can be further accelerated by warmer temperatures but these are not essential: mould grows on food in fridges for example, as long as its nutrition has a high moisture content. These features of mould have been known for a very long time before these standards were published.¹⁷

Air movement does have the potential to dry moist materials. The surface of a moisture-containing material such as an internal wall that sits against earth outside with no moisture barrier will dry out if air is blown across it constantly. It is commonplace to dry a damp wall by preventing the build-up of vegetation against it or digging a trench alongside it and allowing the natural air movement outside to draw out moisture and keep the external surface dry and reduce moisture penetration. In the past the solution to moisture penetration inside a basement store has been to introduce rapid movement of air inside the room instead of remedying the source of the moisture. When archives have been accumulated in a damp room such as a basement a solution brought in to deal with this problem was HVAC equipment.

The standards referred to here reflected those assumptions in context, anticipating that the costs or practical obstacles of remedying problems in the many archive store buildings that had been inherited by archivists and building managers over generations were too insurmountable solely to recommend such structural improvement. Gradually but steadily institutions came to rely solely on mechanical engineers and the budgets held by building managers to dictate what was possible and affordable. Quite simply, it was perceived to be easier and in the short term at least cheaper to fit a new piece of equipment than to fix the structural problem. It appears the ongoing costs of energy and maintenance were not routinely included in comparing the cost of equipment versus the cost of providing a dry environment and, of course, while the standards actually said you needed to move and refresh

¹⁷ For example, see Snow et al. 1944.

air constantly regardless of the moisture properties of the structure there was no reason to do anything else but fit the equipment. This inevitably led to design engineers being seen as the pre-eminent source of knowledge needed to define how best to store archives. Archivists were obliged by building managers and architects to defer to the engineers in defining what is best for environmental protection of their collections. In every building project this author has been involved with (dozens over three decades) it has been the mechanical and electrical engineer who has been delegated by the project team and architect to define the environment and how it should be achieved even while demonstrating an absence of understanding of the nature of archival and library materials. Similarly, when reviewing failing systems in existing archives, building managers have deferred to maintenance engineers and largely ignored archivists, librarians and conservators.

This historical analysis of reasons for increasing organisational reliance on HVAC is one perspective; another is the failure accurately to comprehend the hygroscopic behaviour of archival materials. Clues as to the possibility of a lack of knowledge are present in the standards. There is for example reference in BS 5454:2000 to environmental control being achieved by the provision ‘of a building, or compartment within a building, that gives... a high level of hygroscopic buffering’.¹⁸ It is true hygroscopic surfaces of walls, for example, can be used to absorb moisture in the air when the RH is high and release it again when it is low, thereby stabilising the air RH somewhat seasonally. But what about the archives themselves? Why would one need hygroscopic walls internally that will offer litres of moisture buffering, when your collection itself contains tonnes of embodied moisture and will give it up when the temperature rises and re-absorb it on cooling?

Another clue is the contradiction of proposing to allow good air movement between shelves to prevent the build-up of high RH but at the same time requiring the use of multiple layers of packaging to enclose records, thereby promoting microclimates inside boxes. If records from a location with a very high RH are placed, well packaged, into the store they will hold that moisture internally for long enough to promote mould growth inside, regardless of the RH of the room air at the time. Certainly, if the store is running HVAC systems continually drying and rapidly circulating air there is the potential for such a moisture-bearing box of archives steadily to dry out but nowhere do the standards suggest that the purpose of an archive repository is to act as a drying room.

These inconsistencies suggest that the relationship between moisture content and safe environments was not understood, nor was the physical and chemical nature of the archival materials. Furthermore, although monitoring environments

¹⁸ BS 5454:2000, Clause 7.2.

was recommended by those standards this did not extend to monitoring inside the boxes and packages holding documents. Perhaps if they had done there would have been earlier realisation that some assumptions were inaccurate. This may have led to a more scientific questioning of what constitutes safe storage for collections.

By the 1990s and beyond computerised control of storage climates and eventually the use of computer modelling became the norm in planning new and refurbished archive stores. The mechanisms for controlling air quality by sensors and equipment were confused with what archive collections needed, apparently without question as to why so many documents had survived centuries without tight mechanical control. BS 5454:2000 asserts that documents need to be stored and used in a strictly controlled environment deviating from a single set point by only $\pm 1^{\circ}\text{C}$ and 5% RH.¹⁹ These numbers are the typical hysteresis values in a computerised building management control system (BMS). They are not the requirements for safe conservation of archival materials which can accommodate wider seasonal variations without harm. It is true that rapid and wide changes in RH concurrent with rapid changes in temperature can cause stress on the structure of the materials but the achievement of stability does not need to involve circulating and changing the air rapidly and continuously. Packaging alone can reduce rapid RH fluctuations from above 10% down to below 3% and conversely stabilising RH by enclosure renders changes in temperature harmless if they remain under a safe maximum threshold.²⁰

The impact on air RH of enclosed hygroscopic materials can be seen inside packages and on a much larger scale inside an archive store where the archives themselves and their hygroscopic properties are the dominant influence on RH readings. In such a scenario the short-term impact of a change in temperature is the opposite of that in the free air of a room. A good example of this can be seen in the graphs below (Figures 1 and 2). The data for these graphs were collected with a temperature and RH logger in the same location in the strongroom at the University of Bangor Archive before it was refurbished in 2015. In the first period the logger was placed on an open shelf; in the second recorded just over a year later it was placed inside a filled archive box on the same shelf.

The opposing patterns of change in each graph demonstrate that while a rapid upward change in temperature in free air will result in a measured fall in RH and vice versa, in the small area of tightly enclosed air inside the box with the mass of hygroscopic materials (paper and parchment) the opposite effect is recorded: the RH rises with an increase in temperature and drops as the temperature drops.

¹⁹ BS 5454:2000, Clause 7.3.

²⁰ For example, see Batterham and Wignell 2008; Toishi and Gotoh 1994, 39.

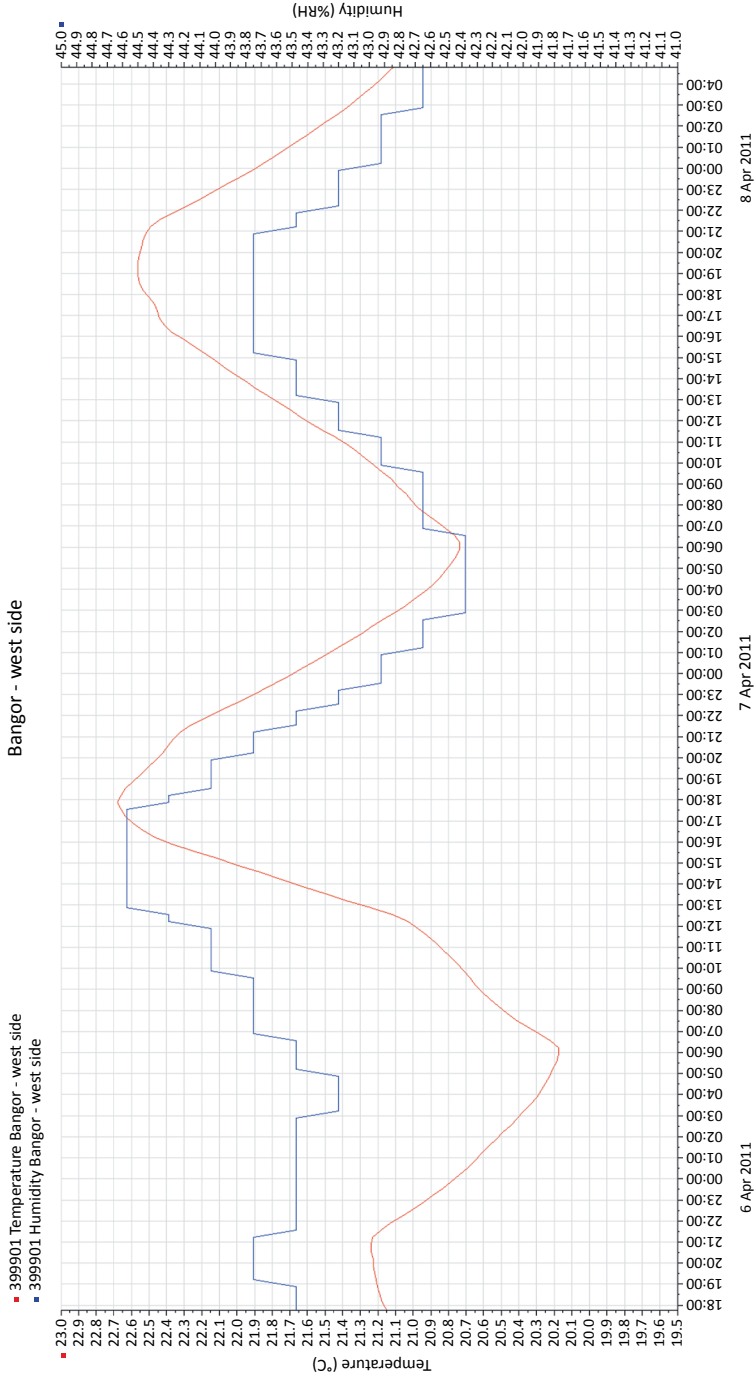


Fig. 2: RH and temperature trends inside an archive box. Image: National Conservation Service

It will also be noted from the above example that the amount of RH change inside a box is much less per degree change than outside a box: 0.6% RH for every 1°C inside compared with 3.7% RH for every 1°C outside.

At this particular archive the sources of rapid and wide temperature changes were resolved by insulation, winter excess heat was greatly reduced by re-routing and removing hot water pipework and excessive moisture input was stopped by removing a fresh air ventilation unit (and winter extreme dryness remedied through the same means). The store has since provided a much more stable and seasonally safe environment through passive means alone.

This examination of inside and outside boxes may seem like a microscopic observation but it is significant because the same effect happens in a room (and indeed in the atmosphere surrounding much of the Earth). A seasonal pattern inside a closed room that has much of its volume filled with archives and books (even one that is not designed to be very airtight, above the level now promulgated in BS EN 16893:2018 of $<0.5 \text{ m}^3/\text{m}^3\text{hr}@50\text{Pa}$) will present the same effect and the more airtight it is the more uncomplicated the pattern. Figure 3 below is a graph of long-term data recorded in a store at Brasenose College, Oxford, across nearly four years from 2015 to 2019.²¹

The upper line shows the periodic data for RH and the lower line for temperature (the vertical peaks are data when the logger was removed for downloading and returned). It can be seen from the graph trends that the RH rises as the summer warms the space and falls as the winter cools it.

There is a considerable imbalance between the weight of water carried by free air and that stored and available in archive and library collections. A single cubic metre of air at 50% RH and 15°C contains c. 0.004 kg of water, or 4 millilitres (a small teaspoonful).²² A single cubic metre of mixed archives (paper, parchment, leather etc.) equilibrated in air at 50% RH contains between 20 and 26 kg (20–26 litres) of water depending on the mix of materials, their age and production. An archive store measuring 10 m x 20 m x 3 m with approximately 50% of its room volume taken up by racks of archives, has c. 8,600 boxes on c. 1,400 linear metres of collections, weighing c. 56,000 kg (assuming c. 40 kg per linear metre of boxed documents). At the above RH this means 8–10% by weight is embodied water, so c. 5,600 litres of water (5.6 tonnes). The other 50% of the room is free air and contains about 1.2 litres of water. If the moisture content of the air rises to read 70% RH this equates to an input of c. 0.5 litres of additional water. If the archives absorb this 0.5 litres of water

²¹ BS EN 16893:2018.

²² For example, see <https://i.pinimg.com/originals/1c/2b/5d/1c2b5d5b0eaf6db9ae0833a0da20aacc.png> (last accessed 23 April 2024).

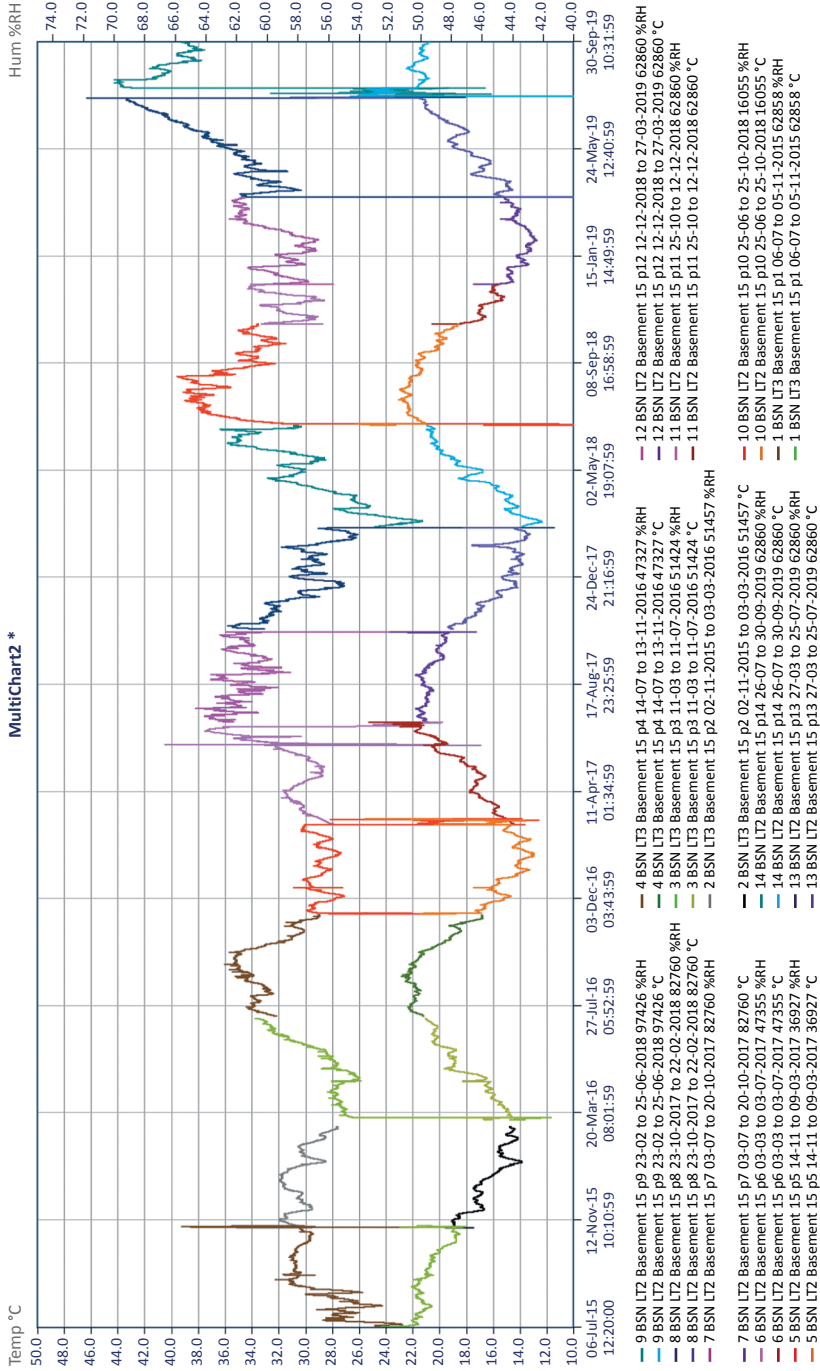


Fig. 3: Seasonal cycles of temperature and RH in an archive store (not purpose-built). Image: National Conservation Service

the RH of the air will drop back to 50% (the equivalent measurement of change for this tiny amount of absorbed water would be so small that no RH sensor would be able to display the difference in RH).

The implications of these observations are that the concepts of engineers and computer modelling used to justify the need for HVAC to control RH have been in error (current thermal modelling software is incapable of modelling the impact on RH of a roomful of archives, only modelling external atmospheric conditions). This has certainly been further complicated by the sector's own assertions that the nature of archives is such that they need tight control to prevent damage. While this might have been understandable in the late 1970s it was inexplicable in the 2000s since much of the scientific research demonstrating that hygroscopic materials present in archives can be safely stored and used across a wider range of conditions than prescribed by the standards was carried out in the 1990s and some of the key work was published in the UK archives sector.²³

Our sectoral weakness in understanding the nature of archives and books and what it takes to ensure that they remain safely stored led to many years of wasted resources and increased risk through the use of HVAC systems intended to 'protect' them. A feature that should be noted is that mechanical equipment wears as soon as it starts to operate and the elements needed to keep temperature and RH within a very narrow range fail very quickly and need to be repaired. When they fail, engineering design has been such that the air supply, with its fresh air make-up following BS 5454, continues to be supplied and circulated through the room at the same rate (e. g. six whole room air changes per hour, every hour, day and night) until someone switches the fans off.²⁴ Furthermore, design engineers have been known consistently to calculate the room air change rate based on the empty room when in practice a store contains 50% or more of its volume in the form of archives, not of free air. So in effect the rate of actual air circulation by volume (in cubic metres) was more like 12 room air changes per hour. In the 2000 iteration of the standard the circulation requirement was to be 'determined from the cooling load to maintain the recommended temperature and humidity in the repository', thereby further removing the decision for what archives needed from archivists and handing it to design engineers.²⁵

By the early 2000s more sophisticated means of controlling mechanical systems were being used, with BMS controllers operated by more and more advanced computers. It was notable in the UK that facilities managers and engineers were review-

²³ McCormick-Goodhart 1996, 7–21.

²⁴ BS 5454:1977, Clause 9.3 and 1989, Clause 7.4.3.

²⁵ BS 5454:2000, Clause 7.5.3.

ing HVAC systems for archives after ten to twenty years of operation and replacing chiller mechanisms, moving from gas refrigerants to chilled water units. These were commonly centralised units that served other parts of the building, extending them to control temperature and RH in an archive air handling unit, a move away from using dedicated chillers for archive control. The objective, anecdotally, was that the new water units were more efficient and needed less maintenance than the old gas systems. Unfortunately, though, no-one in the engineering community involved appeared to have noticed that they would not work for dehumidification, particularly during the summer with high moisture content fresh air and even during the winter if the store air was cooler. The cooling coil temperature was frequently not low enough to reach the dew point and condense sufficient water out of the air to achieve the required conditions (a maximum of 60% RH).²⁶ The result was widespread failure of RH control and very high RH air being blown through rooms at the usual high velocity. This story is common to archives across the UK. More mould outbreaks and more widespread outbreaks (spread across a whole archive by the circulating air) were caused during this time as a consequence of failures of this kind than are likely to have been caused in stores with no such ‘control’.

A most common concern expressed to this author over the past quarter century has been that archives and librarians (and where present conservators) had no control over HVAC systems. They knew when there was a problem but had no authority to ensure that it was resolved and no access to BMS or manual control mechanisms. They were not even allowed to switch off HVAC units even if they knew how to. This shift of authority over collections conservation away from custodial professionals and towards building managers and engineers represents a generational change in management culture, not just a change in knowledge about the nature of books and archives and what they need in order to be conserved sustainably.

The wasted energy, carbon emissions and money caused both by misdirected standards and by the gradual takeover of control of archive store climates by non-experts cannot be overestimated. Finally, in the 2020s society more widely has begun to realise that energy is too expensive to waste and the carbon emissions caused by constant HVAC operation are contributing to climate change. Locally, archives and libraries have been learning that HVAC control of storage environments has not provided the protection that they needed for their collections. The concept of passive climate storage has been discussed and explored with vigour.²⁷ Passive storage is not new: arguably it is as old as the oldest documents and manu-

²⁶ BS 5454:2000, Clause 7.3.3.

²⁷ See for example Ashley-Smith et al. 2012.

scripts since mechanical control is a very recent possibility but also something that was being explored in the 1990s but which did not get taken seriously in the UK until this century.²⁸

One recent impetus for exploring passive storage is the emergence of new standards that reviewed and replaced BS 5454. The key standard covering buildings that are intended to house all forms of heritage collections including library and archive materials is EN 16893:2018.²⁹ It was developed as a European replacement for the subsequently withdrawn BS 5454 and BS PAS 198:2012 *Specification for managing environmental conditions for cultural collections* and its drafting was led by the UK conservation and archives community as a direct response to the changing awareness of the weaknesses of the use of HVAC, particularly for hygroscopic collections including archives. It took the approach outlined in BS PAS 198:2012 of using risk assessment to make decisions about conditions for storage of different materials rather than defining fixed constants and added to it reviewed clauses concerning construction and improvement of buildings with an especial emphasis on requiring the design of storage and display spaces whose internal conditions do not rely on HVAC control.

For the first time in such a standard the principle was set out that a combination of airtightness, thermal stability and protection from water was key to achieving safe and stable conditions for collections in storage. EN 16893 does not set out required temperature and RH parameters for any specific material; it is a construction standard for the design and/or refurbishment of buildings that hold any form of moveable cultural heritage. In the UK archive and library sector another standard, BS 4971:2017, which was produced in tandem with EN 16893 (drafting of both led by this author), covered the specifics for archival collections. Formerly, this British Standard code of practice covered the ‘repair’ of documents. In its new iteration it sets out preventive conservation methodologies including the environmental management of archival collections and asserts that this should be achieved without mechanical intervention.³⁰

Both standards encourage review of existing buildings with the objective of achieving safe environments in compliance with their clauses. For many existing archive and library stores this means switching off HVAC systems (failing or otherwise) and following this with a period of testing and exploration. The objective is to establish whether and how the store structure and its location can provide suitably cool conditions across the year (an annual average temperature lower than 18°C),

28 See for example Cristoffersen 1996.

29 BS EN 16893:2018.

30 BS 4971:2017, Clause 5.1.2 Environmental stability.

allowing for warming in summer as long as there is natural cooling again in winter down to a safe level and relying on air tightness and the presence of the collections to stabilise RH and moisture content. In many instances, as long as a store has an uninsulated ground-contact floor slab and/or is well insulated against external temperature influences, this is easily achievable. Even stores with poor levels of airtightness have been shown to maintain a safely low RH for a prolonged period as long as the volume of archives in the stores are sufficient to dominate the RH of the air. The greater the level of airtightness the longer the time over which a collection's moisture content will remain at a safe low level (e. g. lower than 60% at the warmest time of the year). A passive climate management methodology is emerging from these many trials and successes.

If a collection of archives and books has been stored in an environment managed by HVAC systems at a set point of c. 60% RH the moisture content of the tonnes of archives will be equilibrated to that level. Switch off the HVAC and with a reasonably airtight structure the RH measured in the space, behind shelved books and inside boxes of documents will be found to be at this 60% level. If this level is the situation at the end of winter when conditions are cool then as the summer warms the room (assuming it is above ground and the sun's warmth has an impact) the RH inside the boxes and the room will rise, placing the collection at risk of mould germination. To avoid this risk water must be removed from the collection as soon as it is safe to do so and thereby to 'recondition' the collection so that it maintains a lower annual RH cycle. This is a similar principle to the use of silica gel in an airtight display case used to 'buffer' changes in RH caused by daily temperature cycles and absorb any moisture introduced by air infiltration. The better the airtightness of a display case the longer the RH levels inside will remain at or close to the preferred levels because the silica gel is not exposed to high quantities of atmospheric moisture. Once the gel has absorbed sufficient moisture, though, it needs that moisture removed in order that it can be re-used and provide the desired case conditions.

At 50% RH, paper holds c. 6% of its weight in water depending on its constituents (wood, cotton, linen, jute etc), leather contains 15% and cotton and linen ~6%.³¹ New parchment at the same levels holds c. 13% water.³² For the sake of calculating the management of moisture content and RH it may be reasonable to assume that a mixed archive contains approximately 10% of its weight in water when equilibrated to 50%. If it holds enough water to create an RH equilibrium of >65%, the archive has absorbed c. 30% more water than it held at 50% RH. An archive holding 50,000 kg of archives at 50% RH has c. 5,000 kg water and consistently at >65% has

³¹ Hansen 1986.

³² Haines 1999.

c. 6,500 kg of water, now weighing 51,500 kg in total, a 3% weight increase (1,500 litres of additional water).

To bring it back down to a level where air RH in a fairly airtight room will not rise to a high RH at the warmest time of the year (bringing it down to say 40–45% RH) it will need water equivalent to c. 4% of the total archive weight to be removed (2,060 kg or litres of water). Managing a passive climate archive store that is at least as airtight as EN 16893 expects involves monitoring inside packages, observing the change in RH across the seasons from cooler to warmer temperatures and, if enough infiltrating airborne moisture has over time caused the summer peak of RH to rise to or above 60%, removing the excess water.

It can be seen from the illustrative sums used here that a great deal of water needs to be absorbed if the summer peak is up to or over 60% RH, especially if it rises from an initial base winter level in early years at c. 40% and an annual cycle of up to 10% variance. This indicates that it will take many years from that base for the moisture content to reach that high. Since it seems there is no scientific evidence that confirms there is always an annual net gain in moisture content regardless of the level of airtightness and annual exchange (for example from the opening and closing of store doors and reading room retrieval during office hours), the simple message is that a ‘dry’ collection in an airtight store that has no other sources of moisture penetration will remain safely dry indefinitely (though it may be safer to assume that this net gain exists, however small annually). Furthermore, the smaller the seasonal change in temperature, from say 13°C in winter, the narrower the cycle of induced RH change across the year (i. e. change only caused in the measurements by a temperature change, not by input or loss of moisture). If the summer peak is no more than 17°C, a seasonal variance of only 4°C, the RH cycle may be less than 4% RH, lifting from 40% to 44% for example, a peak that does not put the collections at risk. This is the scenario that existing archives need to work towards and new designs need to promote.

When testing the properties of an existing archive by switching off systems, since it is often a failed HVAC dehumidification system that has caused high moisture content, using that system will not reduce the water content to ‘reset’ the collection (though in some instances, simply closing off the fresh air make-up to the supply improves the capacity of the chiller coil to remove moisture from a now recirculating-only air supply). In this scenario another form of dehumidification is needed temporarily. Drying this collection to bring it from >60% RH down to c. 40% will take a finite amount of time that is determined by the water extraction capacity of the dehumidifier used and the size and airtightness of the archive. Using the above 51,500 kg ‘moist’ archive example and applying a desiccant dehumidifier that extracts 35 litres per day on recirculating air only and constantly drying (with very low air infiltration from elsewhere), it will take as little as 28 days of energy input

to remove the necessary amount of moisture. Once this is done the collection should be safe for many years to come if the building structure supports it.

Critically perhaps, the above means of managing the climate in the stores means manual control of dehumidification, allowing the air that is a vehicle for drying collections to continue to dry even when room air returning has reached the levels sought inside boxes. The RH in a box and within archive materials (or within the text-block of a book, evinced by monitoring in the enclosed space behind shelved books) must reach the target levels to be deemed 'dry' and will do so more slowly than the recirculating room air returning to the dehumidifier. Allowing a BMS sensor to monitor only the free air to control the dehumidifier will cause the dehumidifier to be switched off automatically when the dry air is recorded by the sensor, only switching back on when more moisture from the collections is emitted into the space. This intermittent drying, switching on and off automatically, will take much longer to bring the moisture content of the collection to the desired level. If BMS sensors can be installed inside filled boxes, they may overcome this, though to date this has not been seen in operation; however, in practice there is no need for this process to be controlled remotely by a computer setting. Manual control, with decisions about when preferred conditions are reached being made by custodial staff, is entirely workable and may be preferable, being less prone to 'tinkering' by well-meaning BMS maintenance engineers or poorly set-up software and hardware.

The reservations of the drafting committee for BS 5454:1977, set out in the Foreword, that solutions for establishing safe conditions in some existing buildings were potentially out of reach, were unduly pessimistic, even if reflecting the more limited materials available at the time. Many ground-level or below ground-level rooms, especially from that era and previously, have uninsulated floor slabs. Improving temperature stability would only involve insulating or re-routing hot water pipes and covering and insulating windows; the ground slab provides both a summer cooling mechanism and a winter minimum threshold. Improving airtightness would only involve blocking up windows, filling holes and wider cracks, putting competent seals around doors including threshold seals and painting the walls and ceilings with a membrane paint (which is invaluable on new constructions also).³³ Rising or penetrating damp can be remediated with tanking paints or tracing and removing the source. Once improved, the need for HVAC control is removed for good, if it was ever a relevant solution.

The above climate strategy implies that there is no place for fresh-air ventilation under any circumstances but that may not be advisable. If a continuous period

³³ For example, see <<https://www.ribaj.com/culture/imperial-war-museum-centenary-archive-duxford-airfield-archtype-sustainability-concrete-corten>> (last accessed 24 April 2024).

of work is needed inside a smaller store, changing it temporarily to an occupied space rather than an otherwise largely unoccupied space, CO₂ levels may rise to an unhealthy level. At that point it may be necessary to allow a period of fresh air ventilation to reduce CO₂. Or if a fire starts inside a store, smoke may need to be extracted after the fire has been put out. One store in the UK has a problem of radon gas emitting from the concrete structure of which it is composed, requiring periodic purging with fresh air. Whatever the reason, ventilating a store for a short period will only have a short-term impact on the collections. Even if it is needed for long enough potentially to increase the moisture content of the collection and there is no moisture control of the fresh air (it can be routed through a desiccant) the above routine of removing any measured increase in moisture content can be carried out safely following the ventilation, with no negative impact. Fitting a means of ventilating, capped off when not in use (which may be never), is always advisable.

The objective of both the recent BS and EN standards is to achieve more sustainable conservation of cultural heritage. The word sustainable is commonly used but not always specifically and it may be worth the archive and library sector defining what ‘sustainable conservation storage’ means and to convey this to engineers, architects and building managers in preparing them to develop new means of designing stores. The foregoing descriptions of how such collections can safely be stored indefinitely in airtight, watertight and well insulated spaces indicates that ‘sustainable conservation storage’ means stores:

- that are not reliant on constant intervention – conditions change slowly, allowing time to understand whether any changes are needed;
- that provide a suitable, stable climate achieved by building structure alone;
- in which climate management is carried out by custodial staff, not automated with BMS space sensors;
- that do not require continuous energy to maintain internal conditions;
- that can be left unattended if circumstances force this (such as pandemics or power failures) without the risk of the internal climate deteriorating.

In addition we should require that stores are constructed using long-lasting materials (ideally with low or no carbon emissions). Reliance on mechanical systems not only perpetuates the carbon emissions inherent in their manufacture and in operation but may also serve to promote the use of short-lived and poor-quality structures which, whenever the mechanical systems fail, place the collections at risk. Constructing well designed, heavily insulated, airtight and watertight buildings to house hygroscopic collections should result in long-lasting structures that do not need to be replaced regularly over the course of the intended conservation ‘lifetime’ of collections. Such planned longevity of buildings will also help greatly to reduce our sector’s carbon emissions.

In recent years numerous archives in the UK have reviewed their store buildings and wherever the stores have been found to be sufficiently sustainable they have ceased using HVAC systems, moving to passive stability and back-up dehumidification only. In doing so they have greatly reduced their current and future financial burdens, are reducing risk to their collections and are playing their part in reducing national carbon emissions. Some organisations find their stores are too poor in quality and are in locations too exposed to external conditions (for example on upper stories and surrounded by spaces that are continuously heated in winter). These organisations find they must make more substantial commitments to relocate stores and invest in good, sustainable design that allows their capital investment to be recouped over time. But when they do, as so many are now doing, they are creating much longer-term storage protection in ways that will conserve their collections for generations to come.

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Stephanie Preuss

Sustainable Paper – A Challenge for Preservation?

Abstract: Due to ecological and economic constraints the use and distribution of sustainably produced papers is increasing, which has an impact on the collections of cultural heritage institutions and their preservation strategies. In addition to alternatively produced papers a wide variety of recycled paper products are part of these collections. Preservation must therefore bring more attention to collecting data on the degradation of such heterogeneous media works¹ in order to be able to plan, implement and establish strategies and measures for the future. What this means in concrete terms will be shown using the example of the preservation data collection from the preservation department at the German National Library (DNB).

1 Introduction

The German National Library is located in Leipzig and Frankfurt am Main and is the biggest library in Germany.² The collection mandate of the German National Library includes all publications in written, visual and audio form published in Germany, in the German language, as a translation from the German language or about Germany since 1913.³

These include the printed works compiled or published between 1933 and 1945 by German-speaking emigrants which are collected in the German Exile Archive 1933–1945.⁴ The German National Library holds not only modern media works but also older originals: The German Museum of Books and Writing holds e. g. the world's biggest watermark collection and the Klemm-Collection with very valuable incunables. Today the German National Library's collection encompasses '43.6 million books, newspapers, journals, musical scores and publications, maps and archival materials in both physical and digital formats'.⁵

1 Media works: this term is used for all items in the German National Library, e. g. books, newspapers, maps etc.

2 Deutsche Nationalbibliothek, *Über die Sammlungen*.

3 Deutsche Nationalbibliothek, *Sammlungsauftrag*.

4 Deutsche Nationalbibliothek, *Sammlungsauftrag*.

5 Deutsche Nationalbibliothek, *Über die Sammlungen*.

Stephanie Preuss, German National Library, Leipzig

In the law regarding the German National Library, in paragraph 2, article 1, it is stated that the media works have to be collected in the original form and to be preserved permanently as national written cultural heritage: ‘Die Bibliothek hat die Aufgabe, [...] im Original zu sammeln, zu inventarisieren, zu erschließen und bibliografisch zu verzeichnen, auf Dauer zu sichern [...]’.⁶

Like other comparable institutions the German National Library collects a great variety of different media works which are heterogeneous in their material composition. In terms of preservation all materials have to be checked for their composition and material type so that a preservation concept due to possible degradation mechanisms can be created. The focus of this article is on sustainably produced paper, its degradation and preservation.

On the German book market sustainably produced media works are gaining a new importance. At this point it must be emphasised that it is in no way the intention of this article to criticise sustainably produced media works, e. g. made from recycled materials, as such. In the interest of environmental protection and the conservation of resources the focus on sustainability in the book and paper production is an important contribution to saving our environment. Nevertheless, from a preservation perspective some aspects must be considered more strongly in the future. The sustainability aspect of the production of such paper itself (ecology, benefits, climate protection and economic efficiency) and its evaluation will not be the subject of this article.

2 Short Context of Sustainably Produced Paper

The collection of the German National Library holds a number of sustainably produced media works. But what exactly are sustainably produced media works? The author of this article defines these papers as those which are produced in such a way that all or part of the resources used can be added back to an economic cycle, and/or are produced in a way that saves raw materials. A lot of parameters such as separating ink or dyes and/or glues from paper and last but not least the fibre quality play a big role in that context. The terms ‘environmental paper’, ‘waste paper’ and ‘recycling paper’ are used for papers which are also often labelled with the attribute ‘sustainable’. In Germany there are many labels for such papers with

⁶ *Bundesgesetzblatt* 2006, Teil I, Nr. 29. Translation (Stephanie Preuss): ‘the library has the task [...] to collect the original, to take inventory, to open up a record bibliographically, to preserve permanently [...]’.

different compositions. What they all have in common is that they describe papers that are reused to a certain extent in economic cycles.

Recycling paper is largely used in economic cycles. It is made of waste paper like writing paper, newspaper and so on. The paper fibres are diluted in water and cleaned in several steps with dyes chemically removed (deinking).⁷ This chemical treatment damages the paper fibres because the fibre length is affected,⁸ with the fibre pulp bleached according to requirements.⁹ There are recycling papers which are not being deinked or bleached.¹⁰ The recycling process is limited in revision (about six cycles).¹¹ Because of the downcycling (reducing of fibre quality) fresh fibres have to be added to get a specific fibre quality.¹²

Paper production has been optimised and changed over time because paper is basically a consumable material. In the past people tried to save resources and developed paper recycling treatments.¹³ For instance in 1774 there were verified attempts in making recycling paper.¹⁴

The environmental protection movements in the 1970s in Germany laid the foundation for the establishment of recycling in general.¹⁵ The 1980s were characterised by topics such as ‘forest dieback’, ‘acid rain’ and other environmental issues¹⁶ while the topic of ‘waste separation’ also came into focus.¹⁷ Since then recycling paper has been part of everyday life.

3 Sustainably Produced Papers Today

In recent years there has been a renewed focus in the industry on sustainability in paper production. The reasons for this are manifold, such as the situation on the paper market worsening economically in recent years and the raw material shortage leading to a shortage in the paper market. Even in common newspapers there

7 Tschudin 2012, 174; Igepa 1998, 78.

8 Leitner 2022, 85.

9 Willemer 1997, 476.

10 Willemer 1997, 477.

11 Igepa 1998, 80.

12 Leitner 2022, 4.

13 Willemer 1997, 477.

14 Willemer 1997, 477.

15 Brumme 2016.

16 Brumme 2017.

17 Brumme 2017.

were articles about this issue.¹⁸ For recycling paper production there was less raw material available due to the pandemic because less paper was circulating¹⁹ while industry-specific factors in general play a role in that context.²⁰ It is understandable that for reasons of economic efficiency and sustainability paper producers and publishers focus on recycling paper and alternatives since the ecological aspect is also an important marketing aspect.

3.1 Paper Labels

There are many labels for recycling or environmental papers in Germany but it is not always easy to get an overview. In the following the main labels are shortly introduced.

3.1.1 Blue Angel

These papers are made of 100% wastepaper and are produced without chlorine, optical brighteners or halogenated bleaching agents.²¹ There are different wastepaper qualities available such as the Blue Angel label which obligates paper producers to use at least 65% of less quality wastepaper for certain product groups in order to guarantee that paper producers use all available wastepaper qualities.²² Up to 5% of other materials like plastics, metals and so on are allowed.²³

3.1.2 FSC Recycled

FSC stands for 'Forest Stewardship Council' and means working under specific sustainable principles to manage forests.²⁴ The FSC Recycled papers consists of 100% recycling fibres but there is no regulation on water or energy saving and the use of chemicals.²⁵

¹⁸ *Der Spiegel* 2021.

¹⁹ *Der Spiegel* 2021.

²⁰ *Der Spiegel* 2021.

²¹ Der Blaue Engel (s. a.).

²² Der Naturschutzbund (s. a.).

²³ Der Blaue Engel (s. a.).

²⁴ Der Naturschutzbund (s. a.); FSC (s. a.).

²⁵ Der Naturschutzbund (s. a.).

3.1.3 FSC Mix

The label FSC Mix describes papers which contain up to 70% recycling paper.²⁶ In contrast to that FSC 100% means that the paper fibres are from 100% FSC certified woods.²⁷ These papers contain no recycling papers.

3.1.4 ÖKOPA

‘ÖKOPaplus’ is made of 100% wastepaper.²⁸ Instead of bleaching the paper is whitened by using natural substances such as caolin, crayon or starch.²⁹ It has to get certified by the Blue Angel.³⁰

3.1.5 EU Ecolabel

The EU Ecolabel is the European label for environmentally friendly products and services.³¹

For paper production there are limit values for energy consumption, water pollution and air emissions.³² The papers can be bleached but using elemental chlorine is forbidden.³³ The raw material has to be certified 50% FSC or PEFC³⁴ but using wastepaper is not obligatory.³⁵ Thus, it cannot be assumed that recycled paper is mandatorily used.

3.1.6 Cradle to Cradle Certification

The cradle to cradle or C2C process strives to have an economic cycle that is as holistic as possible in which all components of production can be returned to the cycle

²⁶ FSC (s. a.).

²⁷ FSC (s. a.).

²⁸ Vencermos GmbH (s. a.).

²⁹ Vencermos GmbH (s. a.).

³⁰ Vencermos GmbH (s. a.).

³¹ EU-Ecolabel (s. a.).

³² Der Naturschutzbund (s. a.).

³³ Der Naturschutzbund (s. a.).

³⁴ Der Naturschutzbund (s. a.).

³⁵ Der Naturschutzbund (s. a.).

completely.³⁶ Papers which undergo such a cycle are certified in a special certification process.³⁷ The use of specific chemicals which can be dangerous or toxic for health and/or environment is subject to regulations in the certification process,³⁸ in addition, there are definitions for how compostable the materials used are.³⁹

3.1.7 PEFC: Programme for the Endorsement of Forest Certification Schemes⁴⁰

PEFC is an international certification system for the forest industry and forest owners.⁴¹

The PEFC label classifies sustainable wood and wooden products;⁴² in the case of paper the label is limited to the origin of the fibers.⁴³ Papers with the label 'PEFC recycled' contain at least 70% wastepaper.⁴⁴

3.1.8 Grasspaper and Other Alternatives

In the book market but also in packaging in the food industry there are more and more alternative components in the paper that are intended to contribute to sustainability. On some tea-packages e. g. you can find the information that it is made of grass paper. Grass is already used as a raw material for paper production, currently mainly in the packaging sector,⁴⁵ but there are also experiments with fibres made of fruits.⁴⁶ 'Stonepaper' is made of up to 80% limestone and up to 20% bio-plastic (HDPE: High Density Polyethylene).⁴⁷ These beginnings in experimenting show that there is an intensive search for alternatives; it will become clear in the next few years whether these alternatives will be able to assert themselves or not.

36 Braungart 2022.

37 Cradle to Cradle Products Innovation Institute 2023a.

38 Cradle to Cradle Products Innovation Institute 2023b.

39 Cradle to Cradle Products Innovation Institute 2023c.

40 PEFC a (s. a.).

41 PEFC a (s. a.).

42 PEFC a (s. a.).

43 Der Naturschutzbund (s. a.).

44 PEFC b (s. a.).

45 Hanecke 2019.

46 Nordig 2020.

47 Leitner 2022, 250–251; Stone Paper Products GmbH 2023.

3.1.9 Rewritable Paper

There is research on papers which can be rewritten. Chinese researchers developed a paper in 2018 with a polymer layer that can be printed with a metal-based salt solution.⁴⁸ The paper and its components are supposed to be non-toxic and environmentally friendly as well as reusable up to eight times.⁴⁹ In 2007, a Japanese company experimented with a plastic paper made of PET which can be reprinted up to 500 times.⁵⁰

4 Challenges in Preservation Especially with Sustainably Produced Papers

4.1 Paper Degradation

Part of the German National Library's collection holds papers which are not of archival quality according to today's standards. These are not exclusively sustainably produced papers but papers that have poor aging properties due to lower production quality. The degrading mechanisms are complex and are therefore only described in general.

In industrial paper production from around 1850 onwards chemicals were used that can permanently damage paper.⁵¹ These are acidic substances that were primarily used for sizing;⁵² the acids destroy the nature of the cellulose chains that make the paper flexible and resistant.⁵³ Therefore the degree of polymerisation is a key factor for paper stability.⁵⁴ In addition, wood pulp (lignin-containing fibers) was used as raw material for paper production,⁵⁵ so that the fibres were shorter due to the milling process.⁵⁶ The acids accelerate the aging of the cellulose (hydrolysis)⁵⁷ while the air pollutants and degradation processes in cellulose can produce further

48 Office Roxx 2018.

49 Office Roxx 2018.

50 Herbst 2007.

51 Bestandserhaltungsausschuss 2019, 3.

52 Bestandserhaltungsausschuss 2019, 3.

53 Althenhöner et al. 2012, 9.

54 Allscher and Haberditzel 2016, 79–81.

55 Bestandserhaltungsausschuss 2019, 3.

56 DIN 32701 2021.

57 DIN 32701 2021.

acids.⁵⁸ This combination and other factors make these papers degrade faster than for example a medieval rag paper, although the influence of the lignin has not yet been adequately clarified;⁵⁹ as a consequence these papers become brittle and yellow. The acidic sizing is considered one of the main reasons for paper degradation in that context while reaction products from bleaching processes can have a corresponding after-effect.⁶⁰ This poses a big challenge for preservation because a lot of these media works are barely usable when severely degraded. Pages cannot be turned, they just break or tear quickly (Figure 1).

Since 1965 papers with a neutral pH – at least in the Federal Republic of Germany – have become more and more popular in paper production.⁶¹ In the 1990s the raised demands of the Frankfurter Declaration from 14 February 1990⁶² were implemented so that many publishers, paper producers and bookstores gradually began to focus on printing books on archival and acid-free paper in order to preserve the written cultural heritage.⁶³

As an international standard the DIN EN ISO 9706:2010-02⁶⁴ was created which defines the characteristics of permanent archival paper. For cardboard and thick cellulose materials in archival quality DIN ISO 16245:2012-05⁶⁵ was defined. In Germany more and more media works were produced with DIN ISO 9706 paper.

Due to their manufacturing process, sustainably produced papers are likely subject to the above degradation mechanisms depending on fiber quality and composition. In addition to the fiber quality as well as the acid problem there is also the fact that foreign substances can also be present.⁶⁶ Furthermore, depending on the source, imported waste papers do not always fulfil quality standards of the German paper industry;⁶⁷ even though the processes for producing recycled papers have improved and continue to improve over the years, an uncertainty factor remains regarding their degradation.⁶⁸ Therefore sustainably produced papers have to be considered in preservation strategies because even ‘...with common administrative

58 DIN 32701 2021.

59 Bestandserhaltungsausschuss 2019, 3.

60 Bestandserhaltungsausschuss 2019, 3.

61 Bestandserhaltungsausschuss 2019, 5.

62 Neß 1999, 501–502, quoted from: Schmidt 2012, 26.

63 Schmidt 2012, 26.

64 DIN EN ISO 9706:2010-02, 2021.

65 DIN ISO 16245:2012-05, 2021.

66 Anders 1997, 478.

67 Leitner 2022, 91.

68 Anders 1997, 478.



Fig. 1: Acidic Paper. Image: Stephan Jockel, German National Library

and book-printing practices it is assumed to be a continuing problem...'.⁶⁹ Even if some recycling papers claim to be ageing resistant, they do not fulfil the criteria for papers with archival quality according to ISO 9706,⁷⁰ which also applies to papers produced according to ISO 20494.⁷¹ To clarify this the Conference of the Heads of the Federal and State Archive Administrations (KLA) and the Federal Conference of Municipal Archives at the German Association of Cities and Towns (BKK) have given

⁶⁹ Bestandserhaltungsausschuss 2019, 3. Translation: Stephanie Preuss.

⁷⁰ Archive im Rheinland 2021.

⁷¹ Archive im Rheinland 2021.

corresponding statements in 2015 and 2019 on that matter.⁷² These statements were directed primarily to the public administration.

In addition to acid-induced degradation papers also degrade under alkaline environments,⁷³ however, these degradation mechanisms are not completely researched yet.⁷⁴

A small digression should also be made about papers and books containing plastics. Depending on the material components plastics can get brittle, sticky or yellow⁷⁵ and the information can stick to the next page if getting in contact with sticky plastic. Coated papers can break, redeem or powder off depending on the coating's components. How alternative produced papers react in the material composite with regard to their degradation properties still needs to be further researched.

4.2 Preservation Strategies for Sustainably Produced Media Works

For acidic books and archival records there is a preservation treatment used globally by many institutions: mass deacidification.⁷⁶ The acidic components in the paper are neutralised and an alkaline reserve is placed in the paper structure to neutralize future arising acids.⁷⁷

In the German National Library about 2.4 million media works have been deacidified since 1994. Degradation processes due to acidic components can slow down under optimal storage conditions after mass deacidification.⁷⁸ Additionally, cold storage can contribute to slowing down degradation processes.⁷⁹ It depends on the collection and its condition which treatment or preventive measurements are carried out, either in isolation or in combination to preserve collections on a long term scale. In addition, economic and ecologic aspects have to be taken into account; to find the best strategy it is important to collect data on different aspects of preservation: e. g. data on storage, collection condition and treatments.

72 Bundeskonferenz der Kommunalarchive 2019.

73 Ahn et al. 2013, 1998.

74 Ahn et al. 2013, 1998.

75 For further information on the degradation of plastics, see Ehrenstein 2007a; Ehrenstein 2007b.

76 Allscher and Haberditzel 2016, 79–81.

77 DIN 32701 2021.

78 DIN 32701 2021.

79 Michalski 2002, 66–72.

Deacidified media works have to be checked regularly for their acidity. If the alkaline reserve is too low, the paper gets increasingly acidic and degradation processes become faster.⁸⁰ After deacidification papers degrade differently,⁸¹ primarily depending on the paper characteristics including the ‘initial acid value’.⁸² Therefore, attention must be paid to these issues. It has to be said that by current research applying mass deacidification early on acidic books is effective.⁸³ Because many factors influence paper degradation it is reasonable to regularly check the surface-pH-value on deacidified books; on originals only non-destructive investigation can be done such as surface-pH-measuring. Ideally test papers should also be taken into account on these matters in order to do destructive tests which cannot be done on originals. However, to measure an effect, these must be statistically valid.

The German National Library has carried out surface-pH-measurements with a pH sensor since 2014 in a large scale sampling on deacidified media works. Its aim is to repeat the measurements about all five years in order to detect any changes.⁸⁴ All surface-pH-measurements with a pH sensor, regardless of the target, are carried out according to the instructions of the KUR project after Ahn et al.,⁸⁵ thus, the results remain comparable despite all uncertainty. After 2014 the first random sampling for deacidified stocks was started while the second sampling only started 2020/2021. Due to the pandemic not all measurings are finished so data is only available for the deacidification years from 1994 to 2005; the random sample includes more than 6,000 measurements with a confidence interval of 95%. Since the single measurement has only limited significance because it is associated with many uncertainties the sample is particularly large in order to be able to determine a ‘tendency’. Of course there are also test papers from each deacidification year which can be used for destructive measurements but they do not fully represent the originals in their natural ageing properties. In this context the approach remains a compromise – but still these measurements are very valuable as they enable long-term quality assurance and thus incidentally generate data for research.

Regarding the data it should be noted that the deacidified media works date from the years 1930 to 1991. They were deacidified with different deacidification methods and are stored under passive climate conditions but unfortunately a precise breakdown by deacidification method and year of publication is beyond the scope of this article. The media works are mainly monographs and series sig-

80 Allscher and Haberditzel 2016, 79–81.

81 Ahn et al. 2012, 51–52.

82 Ahn et al. 2012, 51–52.

83 Bestandserhaltungsausschuss 2019, 4.

84 Ahn et al. 2012, 70.

85 Ahn et al. 2012, 79–81.

natures. Figure 2 shows the results of the measurements from 2014 and 2021, comparing the deacidification years 1994 to 2005. It becomes clear that, excluding the deacidification years 2004 and 2005, the majority of the books show a surface-pH higher than 6.5 in 80% or more. A pH 7 is reached in over 70% or more except for the deacidification years in 2001, 2004 and 2005. Especially in the deacidification year 1994, the values decrease compared to the first measurement and it can be assumed that the alkaline reserve was depleted in this deacidification which occurred furthest back in time; this is also to be seen in the deacidification years in 2001, 2004 and 2005. These media works were very acidic before deacidification treatment and were also not stored under optimal conditions whereas the other media works were stored constantly under stable climate conditions but not cold storage. The applied deacidification method could only imply little alkaline reserve into the media works deacidified in 2001, 2004 and 2005. This example already shows the influence between the initial situation of the object condition, storage conditions and the implementation of the alkaline reserve. The measurements which require personnel resources are valuable in order to measure the sustainability of the treatment; this ensures the ability to intervene at an early stage if necessary. The storage conditions have been optimised for these media works today. Summarising the results, it can be stated that the mass deacidification treatment is effective since the results show an alkaline surface-pH in average.

In the German National Library severely degraded media works are digitised by a specific course of business because deacidification is either not possible or

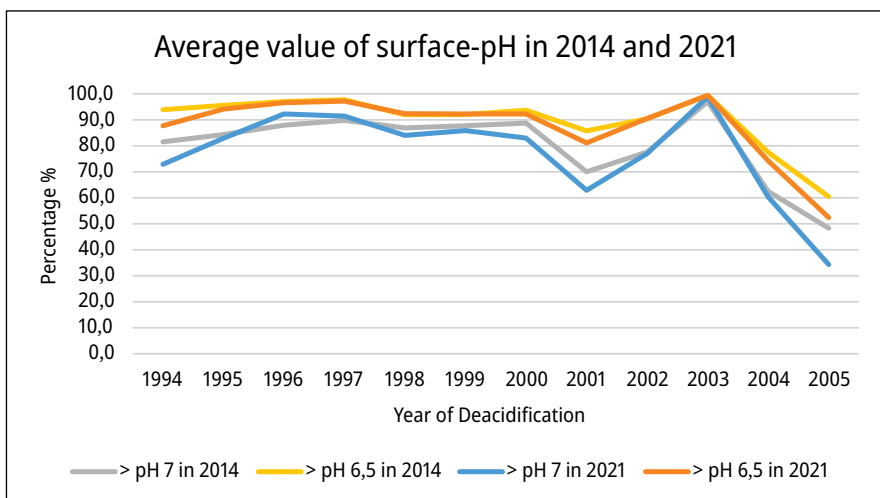


Fig. 2: Average value surface-pH in 2014 and 2021. Image: German National Library

uneconomical in relation to its benefits. These media works are boxed after digitisation and excluded from use; internally they are called ‘mummies’. It must be said, however, that not all papers from that period exhibit this problem since higher-quality papers continued to be produced and used for higher-value publications.

For media works which are not acidic in the first place – many modern papers do have an alkaline reserve even though they are not complying to the DIN ISO 9706 – a regular monitoring concerning their condition (visual examination regarding individual damage categories + material composition + surface-pH-measurement + storage conditions) is reasonable. Data collection requires appropriate resources but is essential from a preservation perspective in order to undertake meaningful action planning and to assess other groups of holdings of the same material composition.

In the case of brittle or glued plastics on or in a book there is, according to current research, little economically suitable conservation treatment to preserve them. In this case at least digitising the information, if technically possible, should be done so that further loss of information can be avoided. Another strategy can be copying it onto an archival paper medium. The same applies to certain coated papers.

It becomes apparent that the data collection for quality assurance and for monitoring the effect of treatments play an enormous role in preservation.

4.3 Collecting Data as an Important Strategy and Resource in Future Preservation

At present there is still not enough data on several preservation issues to make it possible for them to be used for research purposes and strategic decision-making. This is partly because on the one hand there are still not enough standards on how to collect such data and how to make it visible and available. On the other hand while condition surveys etc. are becoming more established data on long-term effects of measures are not yet sufficiently available. Such data can provide valuable information on how certain types of media degrade after a conservation treatment such as mass deacidification; in particular, data on the natural aging of media works are naturally scarce, however, if these are collected on a regular basis this could represent valuable information for future generations that can be used for research and not least for strategic conservation. This is especially true for objects made of alternative composite materials for which there is as of yet little data. Data on mass deacidification, re-acidification, climate data, regarding different storage concepts and of media works themselves (material composition, condition, state of aging, etc.) can contribute to the ability of other institutions which can benefit

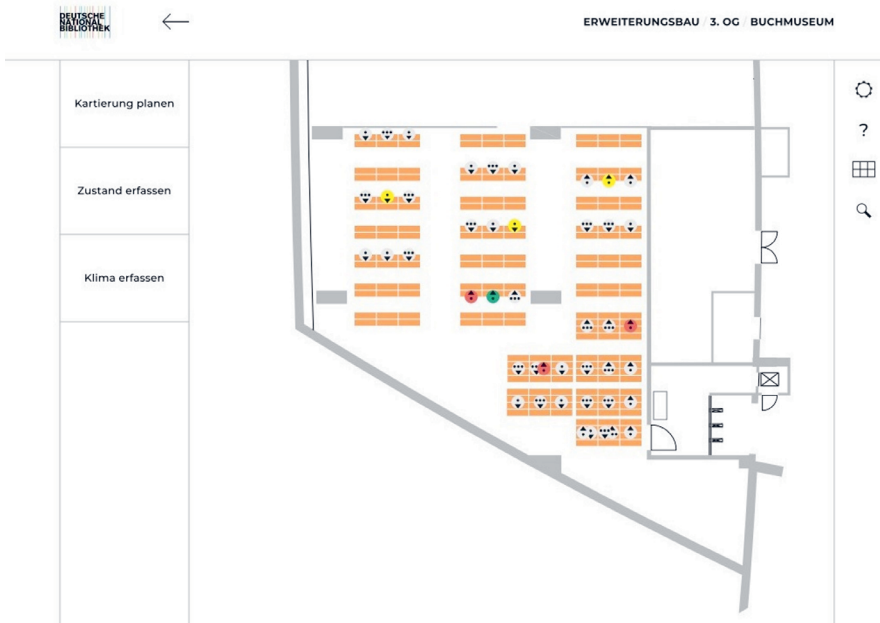


Fig. 3: App Bonpland for Condition Control German National Library, Design: CLMNZ/Clemens Hartmann. Image: German National Library

from this data as they may not have the resources or expertise to collect data themselves. Such an approach requires clear guidelines and unambiguous definitions of damage patterns, measures, description of storage conditions, etc. It initially consumes resources and is also highly complex but it is worthwhile in the long run to consider and plan a holistic cultural heritage conservation strategy regionally, nationally and ultimately globally. There are initial approaches where data collection has begun, e. g. in the form of queries of certain parameters in institutions on preservation issues as the basis for a concept development, e. g. for a state programme on preservation.⁸⁶

The German National Library has begun to collect certain preservation data on these issues. Because the collections are inhomogenous but also because storage conditions at both sites are different the data situation is complex and variant. Additionally, over the years different types of preservation treatments came into use. With a software company an app called Bonpland was developed for the German National Library in which maps of the storage rooms visualize objects' condition,

⁸⁶ See for state programmes on preservation Graf 2022, 25–38.

data on climate condition and other relevant storage and/or object data (Figure 3). On the one hand this provides an overall view of the condition of the media works and on the other hand it allows specific questions to be asked such as the acidity of certain media works. Overall it is important for such surveys to define clear categories that are also clearly comprehensible for other stakeholders; evaluation forms such as ‘good’ or ‘bad’ with regard to e. g. the conservation status are therefore not sufficient. Also, the possible bias which is always present in measurement data must be outlined as precisely as possible. In the app it is possible to measure quickly the condition of media works in stocks or in a segment with a statistically valid random sample with a confidence interval up to 95% (variable adjustable). The collected data is used for strategic preventive treatment planning in preservation which can be transferred to other data analysis programmes so that they can be used more widely in perspective.

4.3.1 Data on the Acidity of Paper in the German National Library

From 2000 up to 2020 the acidity of paper in monographs was checked during indexing the media works in the German National Library. A pH-pen was used and information about the paper composition/type in the imprint were checked. Using a pH-pen, however, is not an exact measurement method; the pen gives an indica-

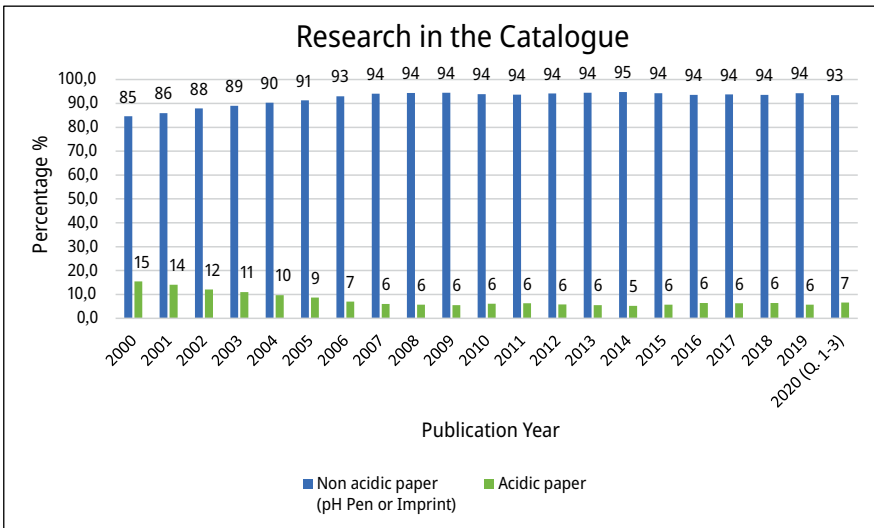


Fig. 4: Research in the DNB Catalogue System. Image: German National Library

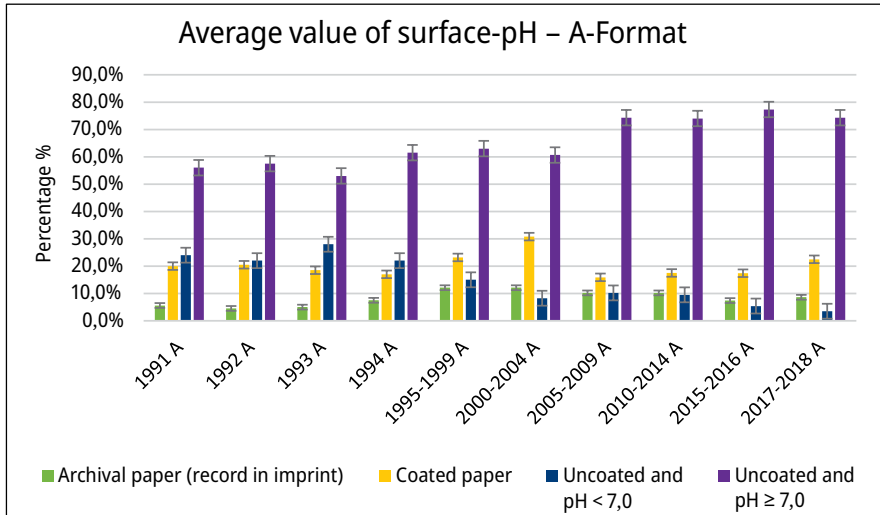


Fig. 5: A-Format – Average surface-pH. Image: German National Library

tion of the acidity since the coloration cannot always be clearly evaluated (e. g. if the paper already has a yellow tint). The results determined are therefore not to be regarded as absolute results and the data thus has a corresponding lack of precision. For this reason the data is no longer collected in this way, however, the available data provides an initial indication. Figure 4 shows that in the early 2000 15–10% acidic paper was detected while since 2007 the percentage nearly cuts in half when the year 2000 is taken as a starting point. The proportion of acidic paper remains stable from the year 2006. However, in 2020, these values were only determined in the first three quarters of the year.

Within the monographs the surface-pH was investigated with a pH-sensor per publication year before deacidification treatment (confidence interval 95%). It was also noted whether there was information in the imprint about the paper composition regarding to archival paper.

It was noted how much coated paper was found because these cannot be deacidified. The results in Figure 5 of the A-Format⁸⁷ show that more than 50% of the paper do have a surface-pH over 7. In the publication years since 2005 the number has even risen to over 70%. Coated paper is present up to 20% in the publication years 2000–2004 while in 2017–2018 it is a little higher. Since 1995 the value for archival paper increased but since publication year 2005 has been under 10% and declined

87 Formats in the German National Library: A-Format Maximum 25 cm, B-Format Maximum 35 cm.

slightly on average. Uncoated paper with surface-pH lower than 7 can be found in the publication years in the early 1990s at slightly more than 20%. Since 1995 the number has been decreasing, since 2000 at less than 10% and 2017/2018 at less than 5%.

It looks slightly different in the B-Formats (Figure 6). Only since publication year 1994 has the number of papers with surface-pH over 7 been higher than 50%, with the average values increase since the publication year 2005 up to more than 70%. The results for coated paper have varied and been higher than 40% in the publication years 1991–1992 and 2000–2004 while being under 30% in the other publication years, while since 2010 they have been around 20%. In the years 1990–2009 less than 5% of archival paper seems to have been used. Only from 2010 have the average values increased while not exceeding 10%. With about 20%, the number of acidic paper in the publication years between 1991 and 1993 is specifically high while decreasing from 1994 to around 10%.

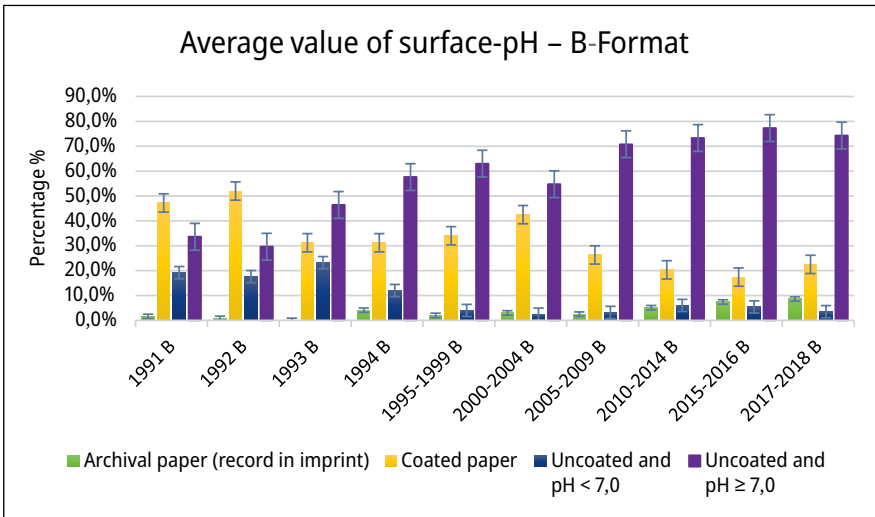


Fig. 6: B-Format – Average surface-pH. Image: German National Library

With regard to the definition ‘archival paper’ it must be stated restrictively that the description in the imprint cannot always be unambiguously assigned to DIN ISO 9706. However, the term ‘ageing-resistant’ or ‘archival paper’ is not always understood to mean the same thing; as already mentioned above some papers are designated as such that do not meet this requirement of DIN ISO 9706. Even if the majority of the measured values determined show a corresponding pH value of more than 7, this does not necessarily mean that these papers also have ‘archival quality’ since other parameters also contribute to this.

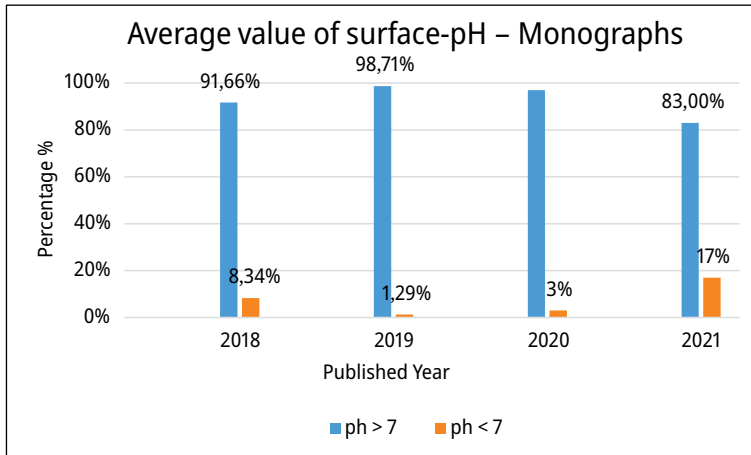


Fig. 7: Modern Monographs A-and B-Format – Average surface-pH. Image: German National Library

In another examination of monographs for the current years only surface-pH-measurements with a pH-sensor (confidence interval 95%) due to resource shortages were carried out. Figure 7 summarises the results for the publication years 2018–2021 for A- and B-Format; it shows that more than 83 up to approximately 98% of the monographs have a surface-pH higher than 7. It is interesting that in 2019 and 2020 a very small amount seems to be lower than pH 7 but in publication year 2018 about 8% of the papers show a surface-pH lower than 7. Nevertheless, in 2021 the number of papers below surface pH 7 nearly doubles in comparison to 2018; whether this is just an ‘outlier’ or whether it is a trend towards acidic paper will be shown in the future measurements for the following publication years.

The preservation department has also started to measure the surface-pH with a pH-sensor of current journals (Figure 8). The data for the publication years 2016–2018 is available, however, the measures are not completed yet since earlier publication years are checked as well. In 2016 4% of the journals show a surface-pH lower than 7 while in the publication years 2017–2018 the surface-pH lower than 7 is around 1%. It will be interesting to see whether the journals of the earlier publication years will show different results.

As already described, many factors determine the deterioration of papers starting from fiber components, chemical additives and other substances and so on. Therefore, their condition must be checked regularly in order to be able to react early and sustainably which applies in particular to papers whose surface-pH is slightly below 7. Despite all the uncertainties of the measurements – because these are not absolute values – these values show a tendency. Besides the surface-pH

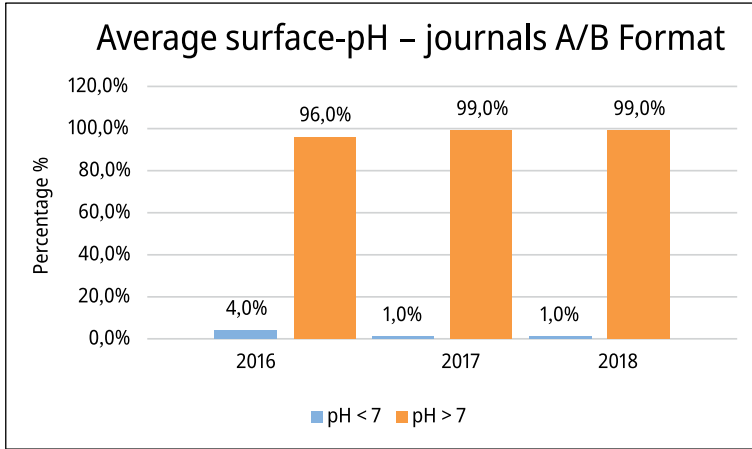


Figure 8: Average surface-pH – Journals A/B-Format. Image: German National Library

other condition parameters have to be checked as well such as yellowing, mechanical properties of the item and others. Last but not least the collection size must also be taken into account. The numbers of the publication years naturally fluctuate; even if only 20% of a publication year needs to be deacidified or treated in another way then for example 40,000 books have to be treated if 200,000 books are considered as the basic population. These investigations have not been completed but will be continued for the coming volumes while the entire periodical and music collection is also currently being examined. Accordingly, no values are yet available. A clearly heterogeneous picture may emerge here as in these collections there are very mixed paper qualities.

4.3.2 Data in Imprint About Paper Quality in the German National Library

In the German National Library data from the imprint of media works is collected in order to see whether the information on paper types is on focus and how the use of paper types will develop, with a current time period deliberately chosen in order to be able to read off developments in the modern holdings in particular. In contrast to the examination before the deacidification which only looked at the information on ‘archive quality’ all information is explicitly recorded here, also in order to include new developments such as ‘grass paper’, etc. The examination has started within the monographic collection with the data available for the publication years 2015–2018 in A-Format (Figures 9 to 12). The random sample was taken with a confidence interval of 95%.

It is obvious that in all publication years the number of not classified paper is highest, making up 70.6–83.6%. But at the same time it can be seen that it reduces due to a greater variety of paper types. Specifically, the FSC Mix papers are rising within the publication years starting from 10% proportion up to 20.1% in 2018 and it seems likely that the use of these papers are rising in the following publication years. All surveys show the presence of archival paper, rising from 0.2% to 7%, however, it is unclear whether this specifically refers to DIN ISO 9706. It is interesting that in the publication year 2015 DIN ISO 9706 papers are present up to 5.5%, but are reduced in 2016 to 1.3% and in 2017 to only 0.7%, while rising again in 2018 to 2.0%. The mention of sustainably produced papers in the imprint is not present in 2015 but is in the publication years 2016–2018 with only 0.2%. In particular, cradle to cradle papers are present in all publication years varying between 0.7% for 2015 and 0.2% for 2016 to 1.3% for 2017 and 0.7% for 2018. Recycling paper is mentioned in the publication years 2016–2018 with small percentages ranging from 0.5–1.5%, while Blue Angel paper can be identified for the publication years 2016–2018 ranging from 0.2–0.5%. FSC 100% paper can only be found in the years 2016–2018 with also a small percentage of 0.2–0.5%.

The following total numbers of media works are extrapolations based on the samples. Considering the number of signatures in the publication years it can be concluded that for 2015, with approximately 110,000 signatures, 11,000 media works consist of FSC Mix papers and approximately 91,300 media works are present without indication of the paper types. Only 5,500 media works are suitable for archiving in terms of paper quality according to DIN ISO 9706.

For the publication years 2016–2018 the number of signatures is about 100,000 media works per year.

If the recycled papers and the sustainably produced papers are added together for the publication year 2016 approximately 16,900 media works (total 16.9%) contain recycled paper/sustainably produced papers. For about 76,500 media works from 2016 the paper composition is not further specified. Only about 1,300 media works from 2016 have a paper quality according to DIN ISO 9706.

In the publication year 2017 about 74,600 signatures have no indication of paper types and about 16,700 monographs are on FSC Mix papers. Only 700 signatures from 2017 have DIN ISO 9706 papers indicated whereby approximately 7,000 media works from the publication year 2017 indicate paper in archive quality.

900 media works of 2018 have information on sustainably produced papers in the imprint. Some 70,600 media works would therefore have no indication of paper quality, while 20,000 media works consist of FSC Mix papers. Approximately 20,100 signatures in 2018 are papers according to DIN ISO 9706 whereby approximately 5,100 media works show at least an 'archive quality'.

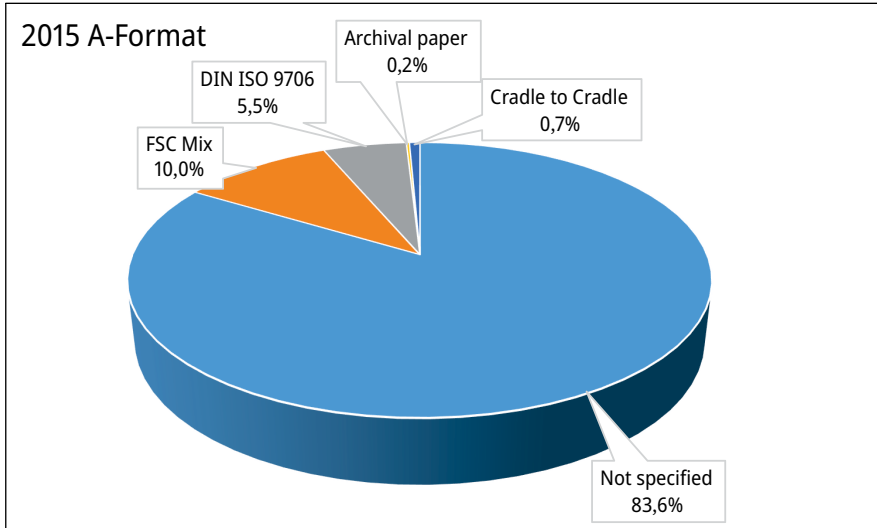


Fig. 9: Paper types in Imprint – 2015 A-Format. Image: German National Library

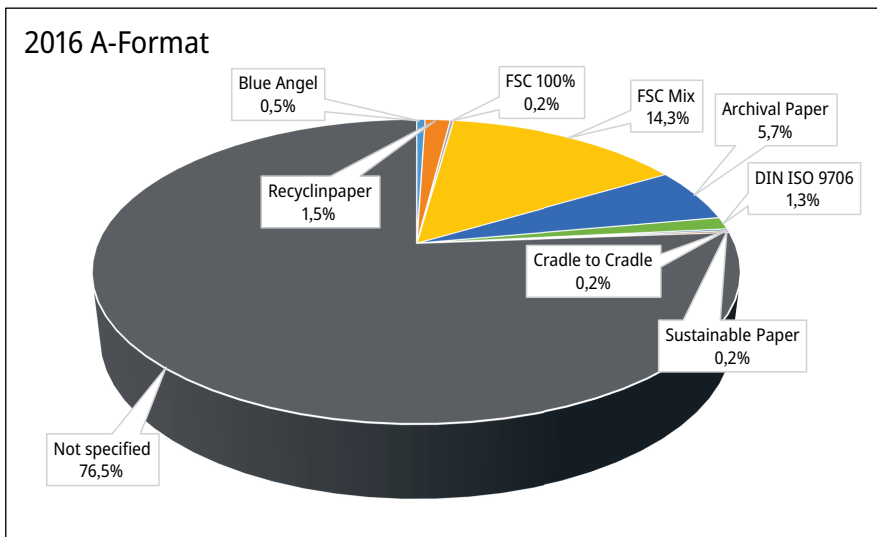


Fig. 10: Paper types in Imprint – 2016 A-Format. Image: German National Library

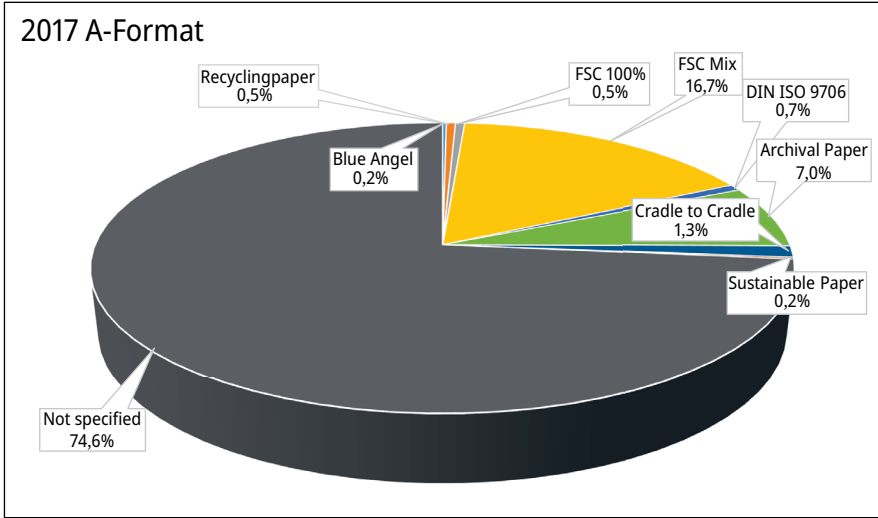


Fig. 11: Paper types in Imprint – 2017 A-Format. Image: German National Library

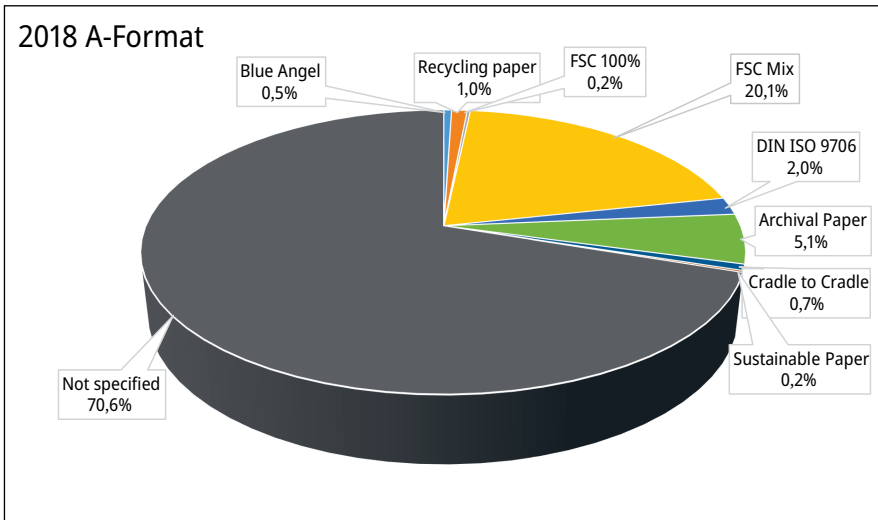


Fig. 12: Paper types in Imprint – 2018 A-Format. Image: German National Library

Figure 13 shows the average values from the publication years 2015–2018. It can be shown that not specified papers make up the largest share at 76.3%. Archival papers and papers in accordance with DIN ISO 9706 account for around 7%. Recycled papers, FSC 100% papers and Blue Angel papers account for an average total share of 10.3%, while FSC Mix papers show a value of 15.3%. Sustainably papers including cradle to cradle papers have an average share of just under 1%. The data implies that over the years more often paper compositions have been named in the imprint. Further surveys will have to show whether trends can be identified from this. Whether degradation processes due to acids or other components will take place must then be checked regularly and if there is a slight tendency towards acidification then it is possible to react at an early stage. All statements are related to the measurements referring to this article but it remains to be seen what the further results will be as the measurements have not yet been completed.

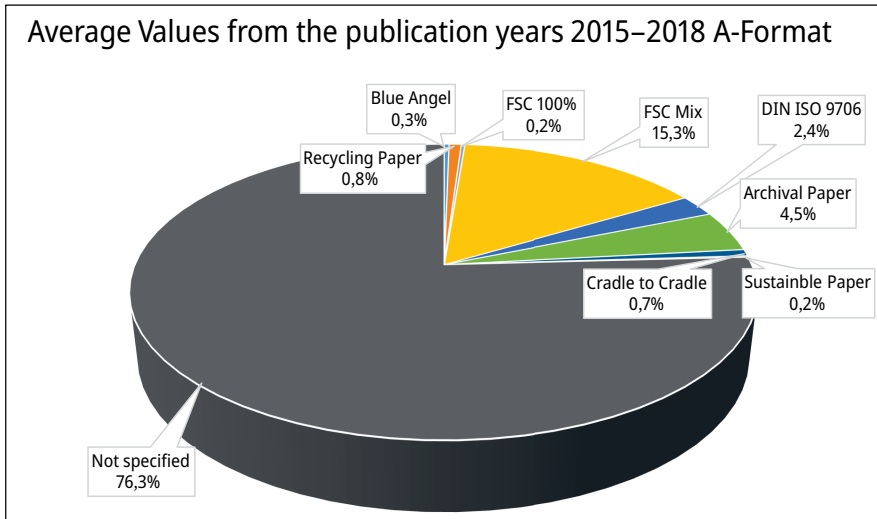


Fig. 13: Average values from the publication years 2015–2018. Image: German National Library

5 Conclusions

Paper qualities play a significant role in the preservation strategy of the German National Library. As sustainability aspects in particular are once more having a stronger role in the book and paper market the focus on this topic is increasing. According to the data currently collected FSC Mix papers are present in up to just

under a quarter of the modern monograph stock depending on the publication year. The still much larger part of the collection does not contain any labelling at all with regard to paper composition, neither in the direction of sustainably produced paper/recycled paper nor in the direction of 'archive paper' and 'papers according to DIN ISO 9706'; it would be great if there is a commitment to label the paper quality in each printed media work. According to the current economic situation it is to be expected that the production towards recycled papers or papers which contribute to sustainability aspects, whether as a mix or fully sustainably produced papers, will continue and increase. Therefore, monitoring the collections of the German National Library will be continued to set up appropriate measures at an early stage in terms of damage prevention and to obtain data for the natural aging of such papers. As the data of the surface-pH measurements shows, a large part of the papers used in books from recent publication years are no longer strongly acidified; nevertheless special attention must be paid to the collections since the paper qualities are different and the distribution seems to shift or change slowly in the publication years. This ensures the ability to react preventively such as in the case of early degradation. The data on deacidified books show that the mass deacidification is effective. Furthermore, alternative papers have to be checked regularly with regard to their degradation in order to create a database for research and for strategic action planning.

Overall, various aspects of economic efficiency, sustainability, preserving information, treatment planning and an optimal climate range must be combined in the best possible way to ensure the most long-term preservation effect. Increasingly, preservation means not only the implementation of certain conservation treatments of the collection but above all strategic decision-making and risk assessment considering sustainability aspects. In this context data collection is just as important as the measure itself. Only in this way can the handling of the enormous quantity of media works be taken into account.

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Jacob Nadal

The Library of Congress Preservation Directorate – Fiscal and Organisational Sustainability

Abstract: This paper describes the preservation administration frameworks developed in the Library of Congress Preservation Directorate and case studies of how these business models were used to make changes in preservation strategy. These include evaluations of how to define preservation strategies and their intended benefits, how to evaluate their total cost and cost efficiency and how to manage preservation activities across different timeframes. These efforts are intended to help preservation support the requirements of the Library of Congress today, across strategic planning cycles, and while making progress on large-scale preservation needs and maintain options for use of the collections over the long term.

1 Introduction

The Library of Congress (the Library) is engaged in an effort to evaluate the health and sustainability of its physical collections preservation program. We need to ensure that the Preservation Directorate can serve as the bedrock for the Library of Congress' mission to, 'engage, inspire and inform Congress and the American people with a universal and enduring source of knowledge and creativity'.¹ We derive this vision of preservation from the paired terms of 'universal and enduring'. These words signal that the measure of preservation has two factors. The collections must endure; this is the minimum outcome of successful preservation. However, the way we preserve them must not be evaluated against simple persistence. Preservation should be evaluated against a goal of universal access and use the perspective of future use to decide on the responsible version of access in the present, not to proscribe present-day access.

The tenth Anniversary Conference of the Coordination Office for the Preservation of Written Cultural Heritage (KEK), 'Preservation in Perspective', provided

¹ Information on the Library of Congress mission and strategic plan is available at <<https://www.loc.gov/strategic-plan/>> and information on the Preservation Directorate at <<https://www.loc.gov/preservation/>>. All URLs cited in this paper were confirmed active on 8 May 2023.

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an opportunity to share the Library's work to date and the presentation given at that conference forms the basis for this paper.² This paper describes the Library's approach to developing sustainable management practices for preservation efforts and explores how this framework for preservation applies to a range of libraries. Our conclusions are pertinent to KEK and other consortia and collecting institutions aside from the Library of Congress in two notable ways. Firstly, we are developing direct measures of how the mission of our institution is sustained by preservation activities. Secondly, we are also finding scenarios where collective investment may overcome cost barriers that prevent individual libraries from utilising the most effective preservation strategies.

Holding over 175 million physical collection items assembled over more than 220 years, the Library of Congress provides ample opportunity to explore preservation strategies.³ Despite having a central role in the organisation's mission and regardless of the specialist skills its staff provide the Preservation Directorate is only another department in an organisation. It requires resources in order to operate and needs meaningful ways to measure the utilisation of those resources. In order to be strategically valuable preservation efforts should yield a collection that is more usable in the present. To be effective preservation strategies should enable that access with little or no risk to the future usability of the collections. The most effective preservation strategies enable access in the present and also improve the likelihood that the collections will remain usable in the future.

2 Framing the Problem: Eternity Approaches One Year at a Time

Libraries, archives, museums and other collecting institutions are charged with keeping things available forever.⁴ These institutions affirm preservation as a prin-

² Koordinierungsstelle für die Erhaltung des schriftlichen Kulturguts (KEK), Preservation in Perspective: Tenth Anniversary Conference: <<https://www.kek-sp.k.de/international-conference>>.

³ General information on the Library of Congress and its collections can be found at <<https://www.loc.gov/about/general-information/>>, and in its annual reports and budgets, available at <<https://www.loc.gov/about/reports-and-budgets/>>.

⁴ The term 'things' can be read technically in this instance as an allusion to Heidegger's 'Ding', meaning an object, an entity in general, or focus of human practices. This essay is grounded in preservation of material records or cultural heritage artifacts but the principles apply to other preservation practices including digital content (cf. *The Cambridge Heidegger Lexicon*: <<https://doi.org/10.1017/9780511843778.202>>).

cial element of their mission. They support preservation and conservation workgroups within their budget and organisational structure and provide physical facilities needed for their workspaces and the storage of collections. Eternity is not a practical management planning horizon, however, so collecting institutions must grapple with the question of how to convert their mission into periods of time that are meaningful in organisational and administrative terms. Within those meaningful durations preservation programs must undertake measurable actions in the present that promote the likelihood that materials will be usable in the future.

The Library of Congress, for example, was created by an Act of Congress on 24 April 1800. After 223 years of operations we could make an assumption that a further 223 years is a meaningful planning horizon. That time-scale is still impractical for program management, however. A preservation budget that requires two centuries for its payoff is not a credible request. Nor, by extension to absurdity, is any governing body likely to fund a large preservation investment in the present on the argument that divided by an infinite stretch of time, the cost of any preservation investment is effectively zero.

To avoid these pitfalls we have been developing a framework or structure for assessing several factors that help to situate preservation activities strategically in the organisation. The first of these are boundaries and suitability of preservation activities to help define preservation strategies in terms of how they specifically support the goals and mission of the Library. Based on those factors we assess total cost and cost effectiveness of preservation activities. This helps justify resources and, equally important, guides us on how to reduce the resources necessary to meet our goals in order to make the preservation effort sustainable. An essential aspect of this is developing sustainable organisational structures and staffing plans to increase confidence that knowledge, skills and abilities can be transmitted into the future.

These are not controversial goals. They are difficult to achieve because of the dilemmas that confront preservation administration. The costs that are affordable in the near-term may not be the best preservation investment while the best investment may pay off outside any realistic planning period. In light of this we also factor in several timeframes or planning horizons to help bring the future into the present.

The long-term goals of preservation invite a temptation for its advocates to argue for resources on principle rather than on merit and to account for preservation investments outside the fiscal and policy mechanisms that actually make the organisation work. This creates a significant strategic risk to implementation of preservation strategies because although preservation outcomes are ultimately measured over decades and centuries libraries operate in annual funding cycles. In each annual scenario it is easier to defer preservation expenses when the benefit of those expenditures comes at an ambiguous point in the future and there is no real

stakeholder for them in the present.⁵ Sustainability requires us to develop activities that can continue into eternity but will also show regular benefits in the present and mirror an organisation's strategic planning period, normally a five-year cycle.

This framework also leads us to acknowledge that some preservation strategies that can solve long-term problems may have no relevance to the mission in the present and may even detract from the goals of the institution. These are difficult conclusions to come to. Those strategies often represent major investments and can become articles of faith: microfilm lasts forever; deacidification is the answer and the temperature cannot fluctuate. If preservation strategies are oppositional to the mission, though, institutions are prone to choose their mission. For preservation at the Library of Congress, confronted with the need to reinvent and revisit our strategies, it is comforting to remember that the final words in our mission are 'knowledge and creativity'.

3 Developing a Preservation Administration Framework

With these issues in mind the Library of Congress Preservation Directorate (PRES) has been revisiting the received wisdom and current practices of preservation and seeking out business models that measure and describe the benefits of those practices in a way that is meaningful to the staff and managers responsible for them. As an outcome of this process we find both effective and ineffective practices but that is not the motivation or most significant outcome. The foremost goal and most valuable part of this work is testing whether we have business models that are useful for showing how preservation supports the overall mission and business of the agency.

In American English there is a colloquial expression of a 'bean counter' who is excessively focused on reducing expenditure regardless of any other considerations or context. By contrast we consider ourselves 'bean enthusiasts' in PRES. We know that less is not always better; we want to maintain and increase the diversity of our proverbial bean patch and the ultimate goal is the right amount for the right

⁵ The history of emergency preparedness and response in any sector is instructive here. Organisations of all kinds attest to the value of preventative measures and continuity of operations planning, and regularly fail in their investments in these same areas. Preservation 'for future generations' is a similar goal – invest now in something that may not make any difference this year – that does not even have the implicit urgency of emergency planning.

purposes. Recipes call for beans by a unit of weight or volume, not by a piece count, and there are beans that are better suited for one dish than another.

The ideal of this approach is to find a good match between mission and business model. This begins when the staff involved feel their work is accurately portrayed and measured in appropriate ways in the business model. In turn, their management needs to see that those measures are persuasive to senior leadership and leadership needs confidence that investments in preservation yield results that matter to the institution's stakeholders. In our work to date we have identified four classes of assessments that are useful to this: boundaries, suitability, total cost and cost effectiveness. We also situate those assessments within particular near-term, strategic and long-term planning horizons.

3.1 Boundaries

One of the important things we have learned is that we have to draw boundaries around distinct preservation strategies. To do this we often test several different assessment methods for any particular strategy to see if they return information that is useful for us for making decisions. If we consider activities such as library binding or the process of transferring an item to storage it is possible to assess the cost and quantity of a very consistent work unit. In turn, it is meaningful to ask questions about doing more or improving quality for the same or lower cost. This is not true for other parts of our program that are central to our effectiveness and to the Library's preservation mission.

In some instances it is more important for us to think about the capabilities we offer or services that we make possible than the level of utilisation of those capabilities. For example, the correct measure of conservation is not necessarily how many treatments are performed in a given period but whether library activities that rely on conservation can occur without impediment. Exhibitions, consultation of the collections and our ability to safely digitise materials are all made possible by the conservation program. It is more meaningful to measure the outcomes in this instance, rather than the outputs.

This outcome-focused approach changes the way we articulate the value of conservation by shifting from counting the number of treatments per year to saying that with this level of conservation investment the Library has been able to sustain a certain level of service. On this basis a preservation administrator might say with pride that although the investment in conservation has been flat over the past several years the Library has been able to increase its services levels in these program areas. This approach supports persuasive arguments, as well. To continue this example, measuring capabilities might lead to saying we cannot continue to

support additional growth in library service levels given our current resources or that we are decreasing our attention to long-term conservation goals to support these other expanding programs.

This approach helps us resolve some classic dilemmas in preservation administration. Some things are very simple to measure such as a per page cost of digitisation, and others are very complex and may seem to defy measurement. In addition to asking whether outputs or outcomes are the most important focus of measurement we have also found value in having a decision-making framework. The *Cynefin* model developed by Kurtz and Snowden has been particularly informative for us given the range and complexity of preservation issues from applied chemistry to emergency response to Zebra barcode and label printers.⁶ Other models may be effective too. It is reasonable to suspect that some value is derived from having any consistent decision-making structure. There is also a pragmatic advantage to using a framework that is accepted within one's organisational context.

3.2 Suitability

Once we have drawn boundaries around preservation strategies and understood the proper way to assess them we can start thinking about how they engage with a library's strategic goals. In short, we are asking if these strategies are suitable for the goals of a library.

To give some examples, the strategic plan of the Library includes a separate digital strategy, in part because of the emphasis on digitisation of collections. As an outcome of this, the preservation directorate had to develop ways to undertake conservation assessment and treatment of materials at large scale so they would be ready for digitisation. PRES also transitioned fully away from microfilm production to digital reformatting.

This led to a stronger connection between certain ongoing investment areas (e. g. conservation or reformatting) and major strategic goals. It also helped us establish more persuasive measures than simple item count such as our transition rate from film to digital. This alignment helped us emphasise how a major research project – effectiveness of heat- and solvent-set tissues, an esoteric subject on its surface – was essential to high-volume digitisation because it established a method for treatment that was safe and fast.⁷

The strategic plan also emphasises the need to enhance the visitor experience to the Library. Over two million people per year come to the Library and the major-

⁶ Kurtz and Snowden 2003.

⁷ Kelly et al. 2022, 24–54.

ity of this traffic is not headed into our reading rooms. Instead, it means attendance at programs and events and viewing exhibitions. To support that we have hired our first objects conservator. We have also improved our processes for microfade testing of objects and materials testing of exhibition casework. We count the number of tests and treatments as a matter of routine and responsible program management, but we measure and report on the value of those changes based on the scope and diversity of exhibitions we can support.

Youth and non-scholarly audiences are an important focus in the current plan as well and that has led us to launch a blog so we have an informal communications platform.⁸ We have also developed workshops for kids and adapted heritage science concepts into classroom lesson plans.

All of those strategies are suited to the current goals of the Library but they are also areas we have chosen because they help us build capacity and expand our options for engagement and outreach in the future. To support digitisation at scale we have also had to develop new collection assessment methods, a protocol for creating care and handling instructions, capabilities that will be useful in future strategic plans even if the focus shifts from digitisation. Hiring an objects conservator supports the visitor experience goals of the Library but it also expands the core capabilities we have for conservation. Launching the blog helps us reach a non-scholarly generalist audience but it also means that we have a useful communications tool that we will be able to repurpose in the future.

3.3 Total Cost

As the boundaries around a preservation strategy and the means to assess that strategy's suitability come into focus it is possible to think about costs in a useful way. In this area there are many commercial business metrics (or analogs close to them) that we have found valuable, especially looking at both known and hidden costs of production and operation, minimum viable costs for operations or staffing. For example, whether a library has two conservators or 20 they still need a lab to work in. It may be a larger or smaller facility depending on the anticipated staffing size but there are some workspaces and pieces of equipment that are required for operations regardless of staff size.

Another crucial aspect of total costs is understanding the opportunity costs of a strategy, the things that we are not doing or are unable to invest in because of

⁸ Library of Congress Preservation Directorate. *Guardians of Memory*, <<https://blogs.loc.gov/preservation/>>.

the decisions we make. Relatedly, it is important to understand the forced costs of certain decisions. Acquiring a collection means storing and cataloging that collection, a subject that has been investigated a number of times from Helen Shenton's work on lifecycle costs for collections to Chela Metzger's recent work on Total Cost of Stewardship.⁹

To date PRES has concluded three separate engagements with Forrester's Total Economic Impact methods, supplemented by our own self-study.¹⁰ As with decision-making frameworks, the consistent use of any method to guide assessment may be as significant as the particular method and repurposing methods already in use and accepted may be the wise strategic decision. Business metrics from the commercial sector have been valuable to PRES in every engagement so far but we emphasise that close attention has been required. Success has emerged from our expertise as librarians, conservators and curators being in dialog with our consultant's knowledge of business concepts. This peer-to-peer conversation makes sure that we apply the right metric to the correct strategy.

To return to the example of counting conservation treatments, even if we create an elaborate typology for different types of treatments and treatment workflows, we may end up doing the wrong assessment. The goal of measuring conservation activities is not simply to increase the number of conservation treatments per year. The real goal is to assess the health of the conservation program and make sure it is enabling the outcomes that libraries require from conservation activities.

Evaluating total cost has helped us shift focus from tallying up large numbers to signal activity towards making better use of those numbers. In our developing framework, by having PRES senior managers focused more on the capabilities the Library needs and understanding the total costs of meeting those needs we open up a few important management improvements. One of those is making sure we do not take actions that have a small direct cost in the annual budget but set up a series of forced costs and indirect expenses that escalate over time or lack oversight by a clearly accountable party. Another is that traditional time and piece counts stats are restored to dignity and become useful tools for line managers to evaluate the health of their operations and determine the right resource levels for them. When PRES management does not ask 'how many can you do' and 'can you do more, maybe with less' and instead asks questions like 'can you provide the capability' and 'are you doing it efficiently', the dreaded 'stats' can become a way to quantify their competency and let the numbers argue for the resources they require.

⁹ Shenton 2003; Metzger 2021.

¹⁰ Forrester Total Economic Impact, <<https://www.forrester.com/policies/tei/>> (last accessed 14 August 2024).

3.4 Cost Effectiveness

This alignment of goals helps connect total costs to cost effectiveness and puts the consultants and their business metrics on the same team as the staff. Cost effectiveness here does not mean spending less money. It means making sure that when we expend our allocation resources we understand how much we help the Library advance its mission. Evaluating effectiveness of costs against the mission and goals helps us avoid efforts to merely reduce spending and focus instead on better utilisation of resources, through reduced overhead and improved tools and techniques. Distinguishing between cost effectiveness and mere cost savings also creates measurable arguments for the delegated authority to reduce overheads, investments in training, automation of rote process, or improved tools and systems. These are all positive improvements in the workplace which help keep everyone focused on finding and refining the purpose of their work by using measures as a way to keep score and mark progress but not letting them become the goal in and of themselves.

The total cost perspective is important in preservation because it is uncommon for preservation to entail direct like for like alternative options. Comparisons based on cost effectiveness often mean a decision about the preferred array of risks or opportunity costs between strategies. This is similar to the way opportunity cost is used in business strategy to evaluate different investment options, even if they are completely different industries.

Opportunity cost and other total economic costs are also important for evaluating preservation options because there are meaningful instances where a choice of a lower total cost strategy does not yield direct savings. Instead, the strategy with a better total cost may mean that we require fewer resources to achieve the necessary outcomes or that we gain flexibility to move funds or other resources from one area to another, meaning the costs are net zero but the outcomes are positive. More work might be performed as a result but a change could be just as meaningful if it means a more diverse array of preservation options for the same total program cost.

An especially important aspect of this relates to sustainability and energy usage in cultural heritage. There can be a political issue to navigate in this as well since many of the cost savings that preservation can enable are in facilities operations and environmental control. Preservation's technical guidance is necessary for a library to make intelligent adjustments that reduce consumption but do not imperil materials. Those savings may accrue to an external party, in our case the Architect of the Capital manages buildings and grounds the library occupies, but a similar arrangement may occur on university campuses or other governmental jurisdictions. In this instance it is important to have the right parties from both organisations involved along with sufficiently highly placed financial decision-makers so that all of the potential beneficiaries of the work can gain some benefit.

3.5 Planning Horizons

Gathering the right stakeholders and potential beneficiaries is crucial to an aspect of preservation administration that sits at the heart of the mission of preservation: thinking about time. There is a glib remark about preservation budgets that any level of expenditure divided by forever is almost nothing. To date, I am not aware of any instance where this rationale has persuaded funders.

Less facetiously, we have an unofficial principle in PRES that we do not even justify budget requests on the basis of 100 years despite having many items in the collections that are already well past that age and that we expect to keep available for centuries to come. Making requests on a very long planning horizon robs the requests of their urgency and at times even seems irresponsible because it shifts accountability for the success of that program outside of our ability to measure or manage it.

Thus, when we plan preservation initiatives at the Library of Congress we are careful to work in meaningful planning horizons. We have to spend money in the present tense which means we also need to show the value of that expenditure in the near term. This is an important shift from framing preservation in terms of keeping things ‘for the future generations’ towards explaining how we will maintain or improve options for use of our collections within a meaningful amount of time. Or, more eloquently, how we make sure that people today can touch the artifacts of the past, begin to care about them and wish to share them with their friends and pass them into the hands of their descendants. We can supply the technical expertise but that groundswell of care is essential to sustaining preservation.

Observation of how our work actually occurs has led us towards a few meaningful planning horizons. The most frequent is what we call the near term which is about three years for us. That is not a law of nature but a practical outgrowth of how work occurs: one or two budget cycles to think about what we need and make the case for those funds, the first year or two, and then apply them to a project, another year or two. Three years is meaningful because it is a duration of work that occurs within a strategic planning cycle (five years at the Library of Congress) which makes it easier to address our goal of keeping work suitable. It also allows us to reevaluate and adapt our programs after the launch of each planning cycle or if there is a major exigency a three-year arc can shift a year and still fall within that strategic planning window. A three-year window also works well for our staff in their individual performance and development plans, allowing sufficient time to do the work as well as the time for training or research that may be needed.

We also think about medium and long-term horizons. Often, we find this medium term or strategic planning horizon falls at about 11 years. That forecasts our efforts across two strategic planning cycles and sets up a prelude to ‘forever’ that we can usefully aspire to. It is meaningful to ask whether choices we are

making in the near-term mean that the Library will have all the options for use of its collections in the next strategic plan and into the one that follows. For us that also means that PRES is implicitly saying that at the end of each ten-year term of the Librarian of Congress their successor will have all the options available to them that their predecessor had.

This horizon of about 11 years is useful for career planning as well. It takes us about a year to recruit and onboard a specialist professional staff member and we routinely see staff having a ten-year career in a particular role at the Library. This planning horizon helps us think constructively about the staff we need to recruit now so that ten years on we will still have the knowledge and capabilities the Library requires.

At the longest we also plan on a 40-year cycle but for several reasons planning past this point has not been valuable. That 40 years is roughly the length of a person's entire career from completing their education to retirement. We do have staff that spend entire careers at the Library and have been able to track the work individuals have accomplished across career scopes of several decades. It is a meaningful arc for us and enables us to think about goals that can be a major legacy. That type of legacy is a profound motivation, to think that the preservation staff to come will remember that you were there when a major milestone was achieved. Note that this is still about one generation to another, though. The necessity of a personal connection is something that has become a guide for us: if a strategy or plan can mean something to somebody, and it is technically possible, success is attainable.

More prosaically, 40 years is also the standard depreciation cycle for a capital investment like a preservation storage facility so it is a timeframe that is relevant to our practice and also aligns with the way governments and institutions account for their money. With this as background we provide two short case studies of how we used these principles in practice to reorganise PRES and to reevaluate a major investment in preservation strategies.

4 Case Study: Organisation for Preservation

The Library has been engaged in a variety of preservation activities since its inception in 1800. In 1900 the Library arranged with the Government Printing Office to establish an in-house bindery. In 1940 the Library established the position of Keeper of the Collections and in 1963 renamed the Keeper's Office the Office of Collections Maintenance and Preservation. In 1965 the Library worked with the Association of Research Libraries to jointly sponsor a national preservation planning conference and we continue to host symposiums and share our knowledge in conferences,

publications and workshops. Later in 1967 the Library consolidated its preservation activities by establishing the Preservation Office (now the Preservation Directorate).

That core organisational structure held stable for over 50 years although the Library developed additional preservation activities in the early twenty-first century at the National Audio-Visual Conservation Center and a growing body of activity in digital preservation. Our reevaluation of preservation activities began in 2017 as both the Library of Congress and PRES went through some significant changes. Carla Hayden was confirmed as the fourteenth Librarian of Congress in September 2016 and under her leadership the agency developed a new mission and strategic plan in 2017.¹¹ In that same year PRES incorporated a newly formed Collections Management Division (CMD) so that end-to-end care of collections occurs within the Directorate, unifying collections storage and inventory control with other preservation activities.¹² This effectively doubled the size of the PRES to about 200 staff and was the first major restructuring of this unit since 1967. In this context, as I started work in July 2017 I was charged to make sure that the expanded scope and ongoing efforts of PRES were integral to the Library's emerging direction.

Our sustainability planning began with a survey to evaluate the satisfaction with and awareness of our services. This was directed to the various collecting divisions PRES supports. We asked questions to learn what they knew about us, what services they used and what services they wanted that we did not offer. We also commissioned internal cross-divisional working groups to provide an opportunity for staff across PRES divisions. These were not primarily intended to create new processes but to surface tacit information and help management understand how work really happened in practical terms rather than the abstract version of workflows presented in briefings and manuals.¹³

We then held a series of organisational planning workshops with division chiefs and key program staff to garner their input on PRES activities from a functional view rather than describing them by the usual organisational lines. Said another way, we made sure to understand how work occurred among divisions inside and outside PRES (functional) alongside how staff were supervised and evaluated (organisational). The intent of these activities was to show that senior leadership

¹¹ Library of Congress 2016.

¹² Haspo 2021.

¹³ Consider for example 'transport', a real box on many workflow diagrams, which in practice can mean navigating a tugger and train of book carts through tunnels, freight elevators and public hallways. The cross-divisional teams help management understand that elevator maintenance is pertinent to their operations, or that the speed of transport is limited by public safety requirements rather than the speed of the materials handling equipment.

would not be dictating a specific change and that we did not have a specific organisational plan in mind. Instead, by inviting staff to participate in ways that they had not previously been asked, we placed value on their knowledge and expertise and used this process to reinforce our own goal for the leadership role to be decision-makers who need to be well-informed.

From these self-studies we learned that divisions provided high quality ongoing services; however, budget practices, policy and cultural factors led them to operate independently and with an assumption of fixed resources year to year. It was risky to reduce resource usage since those resources might never return and also difficult to obtain additional resources even when they were needed for only a short period or one-time investment. Opportunities were difficult to pursue and issues outside core operations could languish.

Rather than try to wholesale change this organisational culture we implemented a reorganisation in 2020 focused on a portfolio approach, arranging functions into clearer centers of authority and responsibility. Divisions could still operate with independence in most areas while at the directorate level attention could go to improving coordination and resource allocation across divisions. At present, PRES is structured into four Divisions reporting to the Directorate Office:

- Collections Management (approx. 100 staff and 20 contractors): inventory control & loans, storage management & space planning, collections logistics, assessment & collection improvement
- Conservation (approx. 50 staff): assessment & treatment, exhibition & digitisation support, environmental control, supplies procurement, emergency response, research & technical development
- Preservation Services (approx. 40 staff): large-scale contract services, reformatting, information systems, assessment & project development
- Research and Testing (approx. 20 staff): research & analysis, quality assurance and standards

Those divisions complete between six and nine million countable preservation actions in any given year, statistics which are invaluable for individual program managers in their work. They do not, however, present a meaningful picture of the directorate's services. Important activities like conservation treatments (over 30,000 items per year), scientific analysis (over 20,000 per year) or emergency response (a crucial 24 hour-per-day service) vanish beneath several million pages of reformatted newspapers and legal gazettes.

Following the reorganisation we worked with the division chiefs to unpack how the divisions approached budget and staff planning. We developed a series of workshops geared towards enabling creative thinking within this portfolio approach to empower chiefs to plan in three-to-five-year horizons. This helps budget planning

stay relevant in the present without being compromised by the specific budget problems of any given year.

In these workshops we asked the division chiefs pointed questions about forecasting work activities over three to five years in their divisions, such as: do you anticipate expanded workloads or requirements in your current program areas?; and will staff require different skills? We had some interesting outcomes including the way succession planning worked for different subsets of staff and that optimising workflows and administrative support across divisions could be extremely valuable.

In another workshop we focused on the non-pay budget which highlighted that the PRES budget is not flat year to year. We had annual budgets that varied by around 30%, from 12 million to 16 million US dollars per year but within each division budgets varied even more. On average that means about 14 million US dollars a year for core operations plus about one million US dollars in situational spending. That provided a basis for thinking about more flexibility for each division year-to-year and held the promise that with better coordination across budget cycles we could address a higher level of divisional need without expanding the overall budget. This is key to making sure PRES is a sustainable cost center from the institutional perspective.

One of the outcomes in the workshop was the impact of large non-recurring purchases such as material handling equipment, lab equipment and exhibit encasements. These are significant and essential expenses but they are not always mission-critical in a specific year and might be deferrable into a different year when resources are more flexible or even advanceable into the present year if funds are available. Now part of our annual budget preparation is to plan two to three years into the future so that we can be intelligently opportunistic about these acquisitions.

In fiscal year 2023 the PRES non-pay budget was set at 14 million US dollars and payroll was approximately 23.5 million US dollars. By adjusting our mix of services and timing of spending we were able to rebalance funding across programs so that each division in effect received approximately 0.5 to 1.2 million US dollars in spending opportunities without enlarging the overall PRES budget. In fact, our budget (both pay and non-pay, adjusted for inflation) has become several percentage points smaller since 2017 while also accommodating this year-to-year flexibility.

We were also able to fund an annual line item for a cost-study program focused on the cost efficacy of large-scale preservation methods over time, meaning the least expensive ways to increase usability of materials while maintaining or improving their longevity. Our goal was to develop a sustainable strategy by attempting to find benchmarks or common points of reference between these preservation approaches that may have different cost structures.

5 Case Study: Total Cost of Two Preservation Strategies

It is useful to consider this example of a progression of costs as an example. These are presented anonymously to protect some vendor costs that contribute to the total cost of these activities and to focus on the patterns that bear on preservation management rather than the specific technical methods at play. In this instance the Library compared one approach (Strategy 1) that required a large one-time investment to add new capabilities but would then lead to a single process that included preservation measures in its flow. The other strategy (Strategy 2) required preservation measures (Strategy 2b) to be taken separately from other processes that affected the collections (Strategy 2a).

PRES considered either approach viable for the purposes of sustaining access to the collections but preferred Strategy 1 since we were more confident it could scale up to a wider range of collection needs. Strategy 1 faced obstacles in practice, however. It required a large start-up cost that was well outside the normal PRES budget allocation and although it was not outside the range of resources the Library could request overall this meant it needed a different level of attention and advocacy. This bears emphasis: for some libraries, the most cost-efficient solution on paper may be impossible in practice because it exceeds the type of investments that library can make. In this context cooperatives like KEK deserve attention for the ways that collective investments can overcome this barrier.

In the initial years Strategy 2 appears competitive with Strategy 1 and in year one positively better. The total cost is roughly half the amount of Strategy 1 in year one and although the costs of Strategy 2b are higher than Strategy 1 in years two and three there is still an advantage overall (see Figure 1).

If this comparison extends through 20 years, however, there is a stark difference. By year ten Strategy 2 has about twice the total cost of Strategy 1 and by year 20 that gap has grown to nearly three times the cost (see Figure 2) This should make for an easy decision: choose Strategy 1 and obtain the lowest total cost. In practice, this was a very difficult decision to make and implement. Against the mathematical solution discussion included questions about the accuracy of forecasts over time and uncertainty of raising funds for the higher initial costs of implementing the more cost-effective strategy. In practice the cost factors forced the discussion and shifted the question from whether we ought to invest in Strategy 1 to a discussion of what would prevent an investment in Strategy 1. That was an important change but not a complete decision. The key additional persuasive element of this decision turned out to be the opportunity to streamline from a two-part operation to a single-stream operation. That is, the parties involved perceived an immediate,

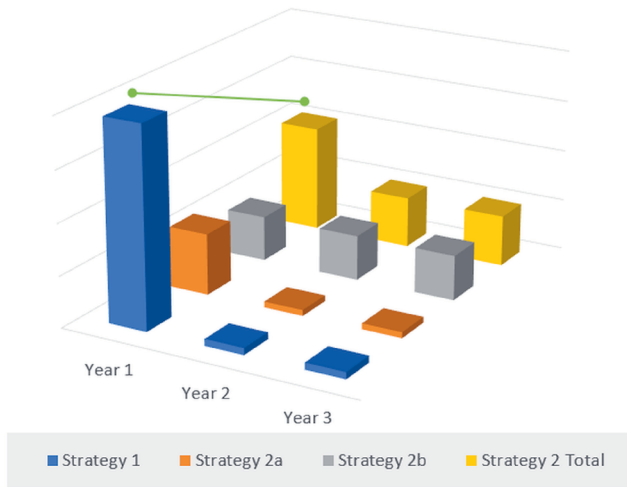


Fig. 1: Comparative costs over three years. Image: Library of Congress

present-tense benefit from the alternate strategy. In turn that enabled us to stop treating uncertainties as obstacles and shift to working through them as problems to be solved on our way to a preferred process.

Our experience making this change in strategy at the Library with its dozens of collecting divisions and multiple agency priorities may also be an indicator for cooperatives like KEK that communication strategy must be considered alongside technical and cost effectiveness in successfully moving preferred preservation strategies into implementation. Even in this case, where Strategy 1 is the clear winner – more cost effective and endorsed by PRES – making the change required assent from dozens of different parties. These parties were internal to the Library, but we feel comfortable with the assumption that the number is a significant factor regardless of organisation structure. The more parties that need to make a decision the slower and more precarious that decision-making process will be.

The dynamics of decisions making was a key lesson for us in retrospect. Communications strategy is something the PRES director's office has started to focus on as an investment that can have significant impact on our ability to implement strategy. Once we have a strategy to pursue, telling the story the right way, to the right audiences, in the right order is crucial. Communications strategy may not prevent a good idea from being implemented but it may slow or diminish its implementation. In formalised, procedural environments like government that can mean additional years from idea to action.

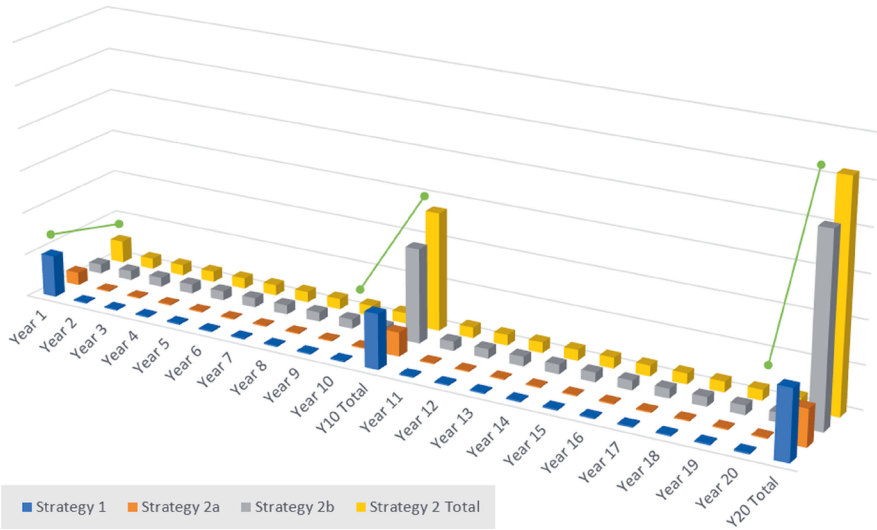


Fig. 2: Comparative cost over 20 years. Image: Library of Congress

6 Conclusion

Planning for sustainability over time is not a turnkey approach for any organisation: there is not a correct preservation structure all organisations can implement but there are effective practices all organisations can use. Sustainability requires developing activities that can continue into eternity while regularly showing benefits in the present. We find substantial value in working with planning horizons like three to five years for a strategic plan; 11 years, or two strategic plans, for major preservation goals; or 40 years, a person's career or the depreciation cycle for a building, as meaningful factors to frame the sustainability of the preservation program. These cycles are meaningful to our collaborators, funders and management. They help us emphasise the user experience of the collections and emphasise the value of our current or near-term future work and create a scaffolding for thinking towards the future in a more concrete way.

As we evaluate our program, we have found several frameworks useful to guide our efforts. These can be framed as a series of questions:

- How do we draw boundaries around preservation strategies?
- Are the current preservation strategies suited to the current needs of the Library?
- What is the total cost of each preservation strategy?
- Is there a more cost-effective way to address that strategic goal?

- Does the staffing plan include the capabilities and diversity necessary to evolve with the needs of the Library?

This process of evaluation has also changed the way we make our case statements about preservation. Instead of formulas like ‘preservation ensures that future generations will have access to collections’ we are making arguments about how concrete value preservation delivers now and emphasising that our professional competency is the essential factor for making sure present-day decisions still set the stage for better outcomes in the future. This is a crucial distinction. It emphasises the value of staff knowledge and the work they do and also avoids the weak argument on behalf of future generations, an appeal to an ambiguous mode of access by a stakeholder that does not exist. This is a preservation strategy that can be easily deferred, year after year. No one knows what those future users will want or when they might want it. Instead we can argue for more meaningful and sustainable goals along the lines of, ‘in the next strategic planning cycle, we will improve options for use of this resource, compared to the present’. And when we need to take that argument out of a budget meeting and appeal to the higher purposes of preservation we still keep our appeal in the present. Our goal is to make sure people today can encounter the collections we hold in trust and our hope is that from that encounter they will want to share them and care for them.

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Notes on Contributors

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Agnes Blüher is a scientific member of staff at the Swiss National Library (NL). After completing her doctorate in chemistry at the University of Stuttgart she was a research assistant to Professor Gerhard Banik in the training programme on book and paper conservation in Stuttgart from 1993 to 1999. Subsequently, she was responsible for the mass deacidification project at the NL; since its completion in 2014 she has been working in the section Preservation and Conservation. Her current focus areas are the long-term control of the deacidified collections and the use of microfading technology in the NL's exhibition policy.

Jody Butterworth

Jody Butterworth is the lead curator at the Endangered Archives Programme (EAP) at the British Library who she has worked for since December 2012. She first joined the Library in 2006, working in the Prints, Drawings and Photographs section of the Asia and Africa Department and then within Collection Care. Her eclectic experiences prior to the Library include working for the National Trust, the Ashmolean Museum and the Royal Collection, teaching English in Japan and China and learning Buddhist thangka painting in Mongolia. Her most recent publication is the article 'Is the Endangered Archives Programme easily accessible to researchers in Africa? Steps toward a level playing field for digitised cultural heritage' (University of Bayreuth, 2022).

Cristina Duran Casablanças

Cristina Duran Casablanças is a book and paper conservator at the Amsterdam City Archives and lecturer in the Conservation and Restoration of Cultural Heritage Programme at the University of Amsterdam. She graduated in Art History from the University of Barcelona and in Paper and Book Conservation from the Dutch Institute for Cultural Heritage in Amsterdam. In 2016 she completed a Master of Research in Science and Engineering in Arts Heritage and Archaeology at the Institute for Sustainable Heritage, University College London. In 2022 she received her PhD degree in heritage science at the same institute. The topic of her research is the modelling of preservation management in archival and library collections.

Michael Fischer

Michael Fischer studied modern and contemporary history and multimedia studies in Karlsruhe, Germany, from 2004 to 2009. In 2014 he earned his doctorate with a dissertation on contemporary history from the Karlsruhe Institute of Technology. From 2014 to 2016 he completed his traineeship for higher civil service in library science at the University Library at the FAU of Erlangen-Nuremberg and the Bavarian Library Academy at the Bavarian State Library. Since 2016 he has been working as a subject specialist at the Baden State Library where he oversees training and the department of subject indexing. Since 2019, he has been serving as deputy director of the Department of Collection Development.

Ulrich Fischer

Ulrich Fischer studied history, English language and literature as well as political science in Trier, Durham and Münster. After completing his MA at Durham University and passing the state examination he earned his doctorate from the University of Münster in 2003. After an archival traineeship in the Land of North Rhine-Westphalia he coordinated the nationwide German Research Foundation project 'Retro-conversion of Archival Finding Aids' for the State Archives of North Rhine-Westphalia. In 2006 he became deputy director of the Historical Archive of the City of Cologne. After the archive's collapse in 2009 he has been overseeing the department for reconstruction, initially as coordinator of salvaging and first response efforts, and since 2013 concurrently as director of the department on 'City Heritage Since 1815'. From 2018 to 2020 he was the founding chair of the Emergency Coalition of Cologne Archives and Libraries in which 24 institutions collaborate around issues of risk management and emergency prevention.

Uwe Golle

Uwe Golle studied restoration and conservation of books, archival materials and cultural assets in Berlin. He is now head of the Graphics Restoration Department at the Klassik Stiftung Weimar [Foundation of Weimar Classics] with a special focus on Eastern European avant-garde and the Bauhaus. His research interests comprise the non-invasive analyses of material technology of prints and drawings of the Klassik Stiftung Weimar. He is developing a comprehensive database for the efficient acquisition and evaluation of measured data.

Josep Grau-Bové

Josep Grau-Bové is a heritage scientist with expertise in preventive conservation, simulation of indoor and outdoor environments and citizen science. He coordinates the Preventive Conservation Lab and directs the MSc Sustainable Heritage while, with the Mobile Heritage Lab, he has conducted participative experiments and public engagement events in institutions across the UK. Furthermore, he leads a team of five PhD students and a post-doctoral researcher. His EU projects have included APACHE (Active & intelligent PAcKaging materials and display cases as a tool for preventive conservation of Cultural Heritage), IPERION-HS (Integrating Platforms for the European Research Infrastructure ON Heritage Science) and E-RIHS-IP (European Research Infrastructure for Heritage Science – Implementation Phase). He currently advises the UK government in the use of heritage science to improve evaluation frameworks of heritage funding and is the chair of the ICON Heritage Science Committee as well as Co-Convenor of the Research Working Group of the National Heritage Science Forum.

Oliver Hahn

Oliver Hahn received his PhD in Chemistry in 1996. After a stint as a research associate in the Department for Restoration and Conservation of Books, Graphic Arts and Archival Materials at the Cologne University of Applied Sciences, he now works for the Federal Institute for Materials Research and Testing (BAM) in Berlin. His areas of special interest include the scientific analysis of manuscripts, drawings, paintings, colorants and inks as well as the preservation of Germany's cultural heritage.

Hahn is head of the institute's Division 4.5 'Analysis of Artefacts and Cultural Assets' and since 2014 he has been professor at the University of Hamburg, Arts Faculty; the Division 4.5 closely collaborates with the Centre for the Study of Manuscript Cultures (CSMC) at Hamburg University and with the Klassik Stiftung Weimar [Foundation of Weimar Classics]. His current research projects deal with the non-destructive investigation of drawings and manuscripts by means of different non-invasive analytical techniques.

Susann Harder

Starting out from an academic background in Egyptology (Leipzig University) and World Heritage Studies (BTU Cottbus), Susann Harder developed her passion for cultural heritage into a career path that focuses on cultural heritage management and the protection of cultural heritage during times of crisis. After more than five years engaging in heritage education and consulting World Heritage initiatives as a scientific researcher with the Institute for Heritage Management she is presently enthralled by the legacy of Prince Pückler at Branitz near Cottbus where she is employed as personal secretary of the board and staff unit for security and disaster prevention. She is a founding member of the German National Committee of the Blue Shield and was elected to serve as its president for the term 2020–2023. Since the disastrous floods in western Germany in July 2021 she has been supporting the mission of the Federal Agency for Technical Relief (THW) as a member of the heavy recovery unit of the Cottbus branch and technical advisor for cultural property protection.

Ville Kajanne

Ville Kajanne, PhD, has a career of two decades at the National Archives of Finland (NAF). Since 2017 he has been participating in defining the concept and launching the Mass Digitisation Service (MD), and currently he is head of the Digitisation Production Unit of MD. He has a broad experience of co-operation between NAF and the ministries and public administration agencies of Finland and furthermore has collaborated in several international projects at NAF (e. g. publications, exhibitions, reunions). On a personal level he has conducted research on international collaboration and transnational intellectual networks between Finland and other European countries in the nineteenth century. Ville Kajanne has completed his studies in both a professional and academic context abroad in Europe.

Johannes Kistenich-Zerfaß

After completing his studies in history and chemistry, his doctorate, an archival traineeship and his first professional position at the State Archives and Civil Records Office of Detmold, Johannes Kistenich-Zerfaß became director of the Department of Preservation Principles/Technical Centre at the State Archives of North Rhine-Westphalia in 2008. In 2014, he was appointed director of the Hessian State Archives in Darmstadt and in 2020, he transferred to overseeing the Hessian State Archives in Marburg where he currently serves as deputy president. Since 2009, Johannes Kistenich-Zerfaß has taught preservation management at the Marburg Archival School – Institute for Archival Science and for a variety of specialist and continuing training courses. In addition he is a member of various professional bodies including the preservation committee within the Conference of the Heads of

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Johanna Leissner

Johanna Leissner is a chemist and materials scientist with degrees from Germany and the US. Her research areas include climate change and cultural heritage, sustainable and energy-efficient historical buildings and sustainability in the cultural heritage sector (green museums). From 2001 to 2005 she was the national expert of Germany in the field of 'Technologies for the Preservation of European Cultural Heritage' at the European Commission, Department of Environmental Technologies in Brussels. Since 2005 she has been the scientific representative for the Fraunhofer-Gesellschaft at the EU in Brussels and in 2008 she co-founded the German Cultural Heritage Research Alliance. From 2009 to 2014 she coordinated the EU project 'Climate for Culture' and co-initiated the annual series 'The Green Museum' in 2010. In 2019 she joined the EU Commission Expert Group 'Cultural Heritage' and the following year she was made coordinator of the German BMBF project KERES about the effects of future extreme climate events on cultural heritage. Since January 2021 she has been chair of the EU OMC Expert Group 'Strengthening cultural heritage resilience for climate change'.

Jacob Nadal

Jacob Nadal is the Director for Preservation at the Library of Congress, a position he was appointed to in July 2017, where he manages the work of the directorate's four divisions – Collections Management, Conservation, Preservation Services and Research and Testing – and provides leadership for the Library's stewardship of the national collections. Before joining the Library of Congress he was executive director of the Research Collections and Preservation Consortium (ReCAP). He has served in leadership roles and developed preservation programmes for the Brooklyn Historical Society, UCLA, New York Public Library and Indiana University where he received his Master's Degree in Library Science. His work has involved developing large-scale cooperative programmes to share and preserve research materials, organising preservation efforts in the aftermath of natural disaster or armed conflict and developing professional capacity through his service as an educator and work on standards development for many aspects of physical and digital preservation.

Richard Ovenden

Richard Ovenden has been Bodley's Librarian (the senior executive position of the Bodleian Libraries, University of Oxford) since 2014. Prior to that he held positions at Durham University Library, the House of Lords Library, the National Library of Scotland and the University of Edinburgh. He moved to the Bodleian in 2003 as Keeper of Special Collections, becoming Deputy Librarian in 2011. He was educated at the University of Durham and University College London and holds a Professorial Fellowship at Balliol College, Oxford. He is a Fellow of the Society of Antiquaries, the Royal Society of Arts, the Royal Historical Society and a Member of the American Philosophical Society; he also was made OBE in the Queen's Birthday Honours 2019 and received the Premio Acqui Storia 'Testimone del tempo' award in October 2021. Richard serves as treasurer of the Consortium of European Research Libraries,

as president of the Digital Preservation Coalition and as a member of the Board of the Council on Library and Information Resources (in Washington, D.C.). He also serves on the advisory boards of Harvard University Library, Cambridge University Library and the German Literature Archive Marbach.

André Eugène Page

André Eugène Page is head of the section Preservation and Conservation at the Swiss National Library (NL). He graduated with a Magister Artium in Conservation from the Academy of Fine Arts Vienna in 1988 and with a Master of Advanced Studies in Arts Management from the Zurich University of Applied Sciences in 2008. He worked as a paper conservator in museums in Switzerland and Germany until 2001 and shortly after joined the National Library of New Zealand as senior paper conservator, enabling him to develop one of his passions: integrating cultural aspects into conservation of collection items. In 2005 he moved back to Switzerland where he took on the role as head of the Conservation Service at NL.

Stephanie Preuss

Stephanie Preuss is a book and paper conservator. Since 2014 she has been head of the Preservation Department at the German National Library, with the department responsible for two locations, Leipzig and Frankfurt am Main. Before 2014 she worked in the conservation studio at the Saxonian Archives; from 2008 to 2010 she was head of the conservation studio at the Zentrum für Bucherhaltung GmbH.

Sam van Schaik

Sam van Schaik has been head of the Endangered Archives Programme (EAP) at the British Library since 2019. He oversees the work of EAP in funding projects to digitise and preserve materials at risk across the world. Before this he was the Research Project Manager for the International Dunhuang Project (IDP), an international digital cooperation focused on Silk Road collections. He received his PhD in 2000 and is a specialist in Tibetan Buddhism and Manuscript Studies. His book *Tibet: A History* was published in 2012 (Yale University Press), with his most recent book being *Buddhist Magic: Divination, Healing, and Enchantment Through the Ages* (Shambhala Publications, 2020).

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Matija Strlič is professor of Analytical Chemistry at University of Ljubljana and professor of Heritage Science at University College London. His main research interests are the development of heritage science infrastructure, including instrumentation and methodology, as well as modelling of heritage materials, environments, values and decision-making. He has published more than 160 peer-reviewed papers and is editorial board member of *Heritage Science*, *Polymer Degradation and Stability* and *Studies in Conservation* as well as a fellow of the Royal Society of Chemistry and of the International Institute for Conservation. In 2015 he received the Ambassador of Science of the Republic of Slovenia Award for his outstanding achievements in science and international collaboration.

Marie Vest

Since 2004 Marie Vest has been head of Preservation at the Royal Danish Library where she is responsible for providing conservation and preservation services for the library's cultural heritage collections and developing preservation plans and strategies. She serves in many professional positions nationwide in support of heritage preservation including committees at Danish Standards and Blue Shield Denmark and is a founding member of the network for Heads of Conservation Departments in National Libraries in Europe. Furthermore, she has taught conservation and preservation at national and international institutions. Prior to joining the library she was a lecturer and researcher at the Royal Danish Academy – Conservation in Copenhagen and has taken part in numerous European research projects on leather and parchment. In 1996 she graduated with a Master in Conservation from the Royal Danish Academy – Conservation. In 1986 she earned a certificate as hand bookbinder, followed by one year of specialisation at Centro del bel Libro, Switzerland to refine her craftsmanship.

Carsten Wintermann

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Chris Woods

Chris Woods is director of the UK non-profit membership organisation for archives, libraries and museums, National Conservation Service (NCS), which supports institutions that do not have conservation staff. He has worked in the archive and heritage sector for over 35 years and founded NCS in 2009 following research and sector consultation as a Senior Fellow at University of the Arts London. His former public sector roles included head of Preservation for Oxford University, Bodleian Libraries and Director of Collection Services, Tate. Woods is noted as an expert in the conservation of archival manuscript and photographic collections and archive storage buildings while also being a conservation adviser to Lincoln, Salisbury and Hereford Cathedrals for their Magna Carta exemplars. He is chairman of the committee for BS 4971:2017, the standard for archive and library conservation, having led its revision and expansion to cover environmental elements of the old BS 5454. He led the development and publication of the standard BS EN 16893:2018 for heritage collection buildings, replacing 5454. He and NCS colleagues advise and support around 200 institutions across the United Kingdom for the conservation management and storage of their collections, including working with approximately 50 on design and refurbishment schemes.