

Preservation policy

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1. Principles

1.1. Introduction

The necessity of the collection preservation work performed at the German National Library is the result of the library's legal collection and archiving mandate, which encompasses all paper-based publications, electronic data carriers and other carriers (media works in physical form) as well as presentations in public networks (media works in non-physical form, "online publications"). Section 2 Paragraph 1 of the Law Regarding the German National Library (Federal Law Gazette I p. 1338) states the following: "The library is obligated to collect media works published in Germany from 1913 onwards in their original format, to catalogue and bibliographically index them, to permanently safeguard them, and to prepare them for use by the general public...". Along with preserving the objects, the aim of all collection preservation measures is therefore also to ensure that the objects remain permanently accessible and usable.

1.2. Collection preservation in the context of the Strategic Compass and the Strategic Priorities of the German National Library

The collection preservation policy is aligned with the Strategic Compass 2025 and the Strategic Priorities of the German National Library, which set out the relevant milestones that the library seeks to achieve.

With regard to the media of the twentieth and twenty-first century in particular, whether physical or digital, there are no truly standardised conservation procedures, quality-management processes or definitive research findings, especially in the long-term view. In future, digital transformation will come to play an ever-greater role.¹ The collection preservation area of the German National Library is a centre of excellence in the preservation of physical and digital holdings from the twentieth and twenty-first century and the development and implementation of relevant mass-treatment processes. It is therefore important that the fields of collection preservation and digital preservation intensively engage with the topic of establishing, implementing and supervising their own conservation procedures; develop quality-management processes along the way; and keep abreast of the latest research findings (preferably interdisciplinary) in order to preserve and consolidate a holistic approach to collection preservation as a whole.

As collection preservation is fundamentally an interdepartmental and interdisciplinary task with mutually related and sometimes strongly mutually dependent requirements, it must be incorporated within an integrated, holistic system that provides permanent access to the various derivations and status information. This particularly applies to the great future challenges faced by the German National Library, namely the interplay between measures for preserving original physical objects and the preservation of digital objects that have no existing original in the conventional sense and which might undergo technical alterations when subjected to conversion processes.

¹ Cf. [Strategic Compass of the German National Library](#), p. 7, accessed: 01.02.2017.

2. General section

2.1. Defining collection preservation

Collection preservation affects all areas of the library, either directly or indirectly. DIN 15989:2011 defines collection preservation as follows: collection preservation puts in place “provisions and measures aimed at preservation while also respecting [the object’s respective] importance, including making [the objects] accessible to current and future generations”.² The starting point is therefore ensuring the permanent accessibility of the material.

The library’s collection preservation work is carried out in accordance with international and national guidelines on the preservation of cultural property, such as the Blaubeuren Recommendations, the [Venice Charter](#), the [Vantaa Charter](#) (relating to museums) and current DIN/ISO preservation standards.

The physical separation of the collections is an important aspect of collection preservation at the German National Library. In the unlikely event of a loss at one site, the storage of mandatory physical copies at both sites ensures that a copy can still be preserved at the other respective site. At the same time, different processes can be used at both sites, thereby widening the spectrum of the methodological repertoire at the German National Library and the range of collection preservation options as a whole. Using the same principles, non-physical media works are redundantly stored at several locations, whereby preservation measures such as migration and emulation are centrally planned and implemented by the Domain Information Infrastructure.

The following guidelines on collection preservation are derived primarily from the legal collection and archiving mandate and, in part, from the organisational structure of the German National Library:

- | the main focus of the collection preservation work performed at the German National Library rests on media from the twentieth and twenty-first century, yet does not exclude older collections and collaborates on an interdisciplinary basis with the Department for Digital Preservation.
- | Collection preservation is not a task that can be performed within a limited time-frame as part of a project. Collection preservation is a permanent task with no fixed cycles and therefore no fixed time-period, at least in principle.
- | Collection preservation is not an isolated task. It affects all areas of the library immediately or tangentially involved in the storage and use of the objects in the collection. Owing to the variety of the collections / holding groups, collection preservation is a highly heterogeneous task requiring a variety of skills.
- | Collection preservation is not a voluntary task; instead, its necessity for the German National Library results from the library’s legal collection and archiving mandate.

² DIN Deutsches Institut für Normung e.V. (ed.), DIN Taschenbuch 409: Erhaltung des kulturellen Erbes, 1st edition, Berlin 2014, DIN EN 15989:2011-12, p. 10.

- | Whereas preserving the original object is key to physical preservation (cf. the KEK Recommendations for Action³), the concept of an “original” plays a rather more subordinate role when it comes to digital preservation. Here, the fundamental objective is to preserve the accessibility and usability of the objects regardless of technological changes.

2.2. Scope of the collection preservation policy

The collection preservation policy applies to the entire analogue and digital collection of the German National Library, including all special collections: the German Museum of Books and Writing, the German Exile Archive 1933–1945, the collection of exile literature 1933–1945, the Library of the German Book Traders’ Association, and the Library of the Frankfurt Parliament 1848/49.

3. Preservation Department

The Preservation Department (Department BE.1) is responsible for the physical holding groups and collaborates on an interdisciplinary basis with the Staff Unit Digital Preservation within the Domain Information Infrastructure. Department BE.1 works across the two sites and serves as a point of contact for both. Appropriate procedures for the various topics have already been established or are in the process of being established. The respective current task areas as well as the necessary financial and human resources are outlined in an internal action plan.

3.1. Quality management

Measures are qualitatively assessed in order to evaluate their sustainability in line with controlling procedures. Uniform standards and, above all, long-term studies are still required for this by the Preservation Department. An evaluation of the measures already put in place is also important.

For these reasons, the procedure for the quality-control and evaluation of collection preservation measures is continuously further developed along various different lines:

since 2014, the workflows for assessing the quality of mass de-acidification, for example, have been optimised. To this end, rooms have been installed in which small-scale analyses and tests can be carried out. The workflows are being continuously optimised in order to quickly develop and establish new insights specifically in this field. There are also workflows in place for the quality-control of contaminated objects and objects in need of cleaning, as well as standards for the tactile/visual inspection of conservation measures.

³ Cf. [Nation-wide recommendations for action of the Coordination Office for the Preservation of Written Cultural Heritage](#) p. 6 et seq., accessed: 01.02.2017.

3.2. Quality assurance

For some measures, there are as yet no standardised quality-assurance measures, so that these are themselves being developed as part of systematic investigations. The ageing behaviour of modern materials such as plastics, certain printing processes, and composites of many different kinds of material are as yet insufficiently known. For this reason, we seek to carry out further additional testing with a practical focus, both internally as well as with external partners, thanks in part to third-party funding.

3.3. Public relations work

The topic of collection preservation requires public-relations work in order to make the public aware of, and sensitise it to, the library's preservation work and the threats our cultural property is exposed to. This work will be carried out in the form of presentations and regular articles in journals or posts on other platforms such as social media. Thanks to pilot-scheme funding, the preservation of Walter Meckauer's briefcase by the Coordination Office for the Preservation of Written Cultural Heritage in 2015 succeeded in generating a lot of media attention. In 2016, a KEK project overseen by the Saxon State and University Library Dresden and other partners was launched with the aim of establishing a test library for research projects focusing on de-acidification.

4. Department for Digital Preservation

Those areas of work primarily affected by issues relating to digital preservation are housed within the Domain Information Infrastructure, which is also responsible for digital preservation. The strategic further development of digital preservation as well as related research projects are embedded within a staff unit overseen by the domain's directorship; operative aspects of incorporating digital preservation within the workflows for online publications are overseen by Department IT.1 Requirements, Specifications, Tests; responsibility for development rests with Department IT.3 Architecture and Development.

Other areas and departments also contribute to the relevant processes. There are dependencies and thematic interdependencies between the departments for digital preservation, online publications, the URN service and the URN strategy. Close organisational coordination is ensured.

5. Damage prevention

The following chapters present measures for the prevention of damage.

We meet all the necessary safety requirements for protecting our collections

The building and the stacks are fitted with security alarms, and the access points are restricted.

The building contains passive architectural security features; in practice, this means that the stacks cannot be accessed without the necessary security clearance, for example.

Keys are only provided to designated keyholders.

A security firm (site security) is in permanent operation.

The requirements for preserving library and archive holdings are adhered to.

5.1. Security measures

The prescribed fire-detection and alarm technology is installed in all buildings of the German National Library. It is comprised of a dense network of smoke detectors in the stacks and in the corridors of the service areas, including the public areas.

The fire-fighting strategies have been coordinated with the local fire-protection services: a sprinkler system has been installed in Frankfurt am Main, designed to keep any fires that occur in the stack area under control until the fire brigade arrives. Both sites hold regular tours of inspection with the service personnel of the responsible fire stations.

Theft protection during the library's regular operations is provided to the greatest possible extent thanks to media-protection systems in all reading rooms and the receipts from the loan-records system. This protection is deemed as adequate by the Domain User Services and Preservation. The loss of media through theft in the reading rooms is estimated to be negligible overall.

During the construction of the German National Library in Frankfurt am Main, the criteria in terms of preservation requirements set out in the standard "DIN ISO 11799: document storage requirements for archive and library materials" were met in full to the state of standardisation extant at the time. Adherence to the requirement for constant climate conditions is ensured.

In the call for tenders to construct the fourth extension to the Leipzig site, attention was paid to the requisite regulations and guidelines for the stack requirements based on the latest standards. The allocation policy for the new stack rooms with optimally set climate conditions is therefore to archive particularly sensitive or previously damaged holding groups here. In addition to the collections of musical scores and sound recordings, media stored on sound and data carriers as well

as museum items of cultural heritage have also been placed in the stack areas with the appropriate climate conditions. At the same time, the stacks in the existing building have been prepared to receive the new additions of newspapers and magazines from 2010 onwards. The more frequently used and more strongly frequented collection is therefore now also closer to the user areas, resulting in shorter transport routes and fewer risks.

5.2. Emergency management – emergency planning and risk analyses

In the event of any damage, speedy and pre-planned action is vital. This is facilitated through suitable preventive measures.

We take all necessary precautions to enable us to act quickly in cases of emergency

The German National Library carries out regular emergency training.

The emergency plan is regularly updated.

An up-to-date risk analysis has been conducted at both sites.

The library works in close collaboration with the fire department.

The German National Library operates in accordance with "DIN 14095:2007-05: ground plans for components for buildings for fire brigade use".

There is a working group for emergency planning at both the Leipzig and the Frankfurt am Main site. The groups' tasks include the creation and ongoing updating of emergency plans.

Emergency alert plans for incidents outside the service buildings' opening hours exist in Leipzig and Frankfurt am Main. They contain the private telephone numbers and e-mail addresses of the library's directors and members of the emergency team (internal service and those responsible for the collections / information infrastructure). It also contains the key emergency numbers and contact details of external service providers in cases of emergency. The emergency alert plans are updated at regular intervals and provided to the members of the emergency team, the general directorship and the building management teams. A copy is also kept at the entrance to each site, as well as in the control room in Leipzig. Discussions are held with the local emergency services, such as the Federal Agency for Technical Relief (Technisches Hilfswerk, THW).

The German National Library is an active participant in the "Emergency Association of Leipzig-based Archives and Libraries", which was founded on 21 May 2012 upon the signing of an appropriate agreement.

5.3. Acquisition and cataloguing of media

We ensure that we take aspects of preservation into account when acquiring and cataloguing media

Objects are subjected to mechanical stress as little as necessary.

Transport distances are kept to a minimum.

Adhesive notes and rubber bands are not used to hold the objects together, as these cause irreversible damage.

Urgently required labels on the objects meet the current standards of preservation.

Appendages are handled in accordance with the internal policy paper "Handling appendages".

Retrospectively acquired objects are examined by Department BE.1 in quarantine rooms.

Objects that can only be mended at great cost are purchased only if they are essential to the collection (decided on a case-by-case basis).

Owing to a variety of circumstances (such as a lack of information regarding the object's history), the condition of individual objects or holding groups is often unknown when these are retrospectively acquired. All retrospectively acquired collections are placed into interim storage in designated quarantine rooms and examined for damage by Department BE.1 before being transferred into the stacks. This avoids potential subsequent damage in the stacks.

A procedure is being developed to ensure optimal collaboration between the Collection Preservation Department and the department responsible for retrospective acquisitions.

5.4. Handling media: users and staff, usage restrictions, copying restrictions, interlibrary lending

We handle our media in ways that help preserve them

Food and drink must not come into contact with original objects. No food or drink is therefore consumed when handling objects.

Original objects are transported as little as possible. If they must be transported, this is done in such a way that avoids exposing the objects to any vibrations or falls. This particularly applies to the book-transport system. When loading book trolleys, attention must be paid to the weight of objects.

The stacking of objects at desks or other workplaces is avoided as much as possible. If books or files and the like must be stacked, they are stacked in a staggered manner – i.e. the spines of the objects are overlapped – in order to make them more stable. The stacks should be kept as low as possible.

Objects with rigid or glued binding are opened in such a way as to keep the opening angle as shallow as possible. Book supports and lead weights are used for this purpose.

Objects are not opened to the seam.

Objects archived in physical as well as digital form are preferably offered in digital format – the physical copy is provided only upon specific request.

Damaged objects are not provided for use, or only in exceptional circumstances and then only under supervision.

In the case of interlibrary lending between the German National Library and other institutions, appropriate records are kept of the respective object's condition prior to lending, and its condition checked once it is returned.

The appropriate handling of objects is described in the Conditions of Use.

In the Conditions of Use, which also apply to library staff, users of the German National Library are extensively informed of their obligations to handle the works provided to them with care and to protect them from damage.

Works that exist as a parallel digital copy are provided in physical format only upon request ("digital before print"). This decision was above all made in the interests of permanently preserving and safeguarding the archived media works.

A procedure is in place for copies that are noticed to be damaged or in need of repair during use.

Before media are provided for exhibitions or for film and digitalisation projects (internal or external), their condition is examined and recorded in the itemisations and lists created specifically for the respective occasion and included in the requisite contracts. When required, individual works are appropriately prepared by specialist staff from Department BE.1.

During regular training sessions, employees are sensitised to the issue of handling the collections appropriately. There are also regular training sessions on issues relating to collection preservation for trainees in Frankfurt and Leipzig (media and information services specialists). New staff members at the German National Library are also given an introduction to the appropriate handling of the library's holdings.

In the case of duplications on request, the German National Library reserves the right to decide the method of reproduction. The reproduction method that causes the least damage will always be chosen.

In the event of external exhibition projects, the respective exhibition conditions are examined (the prospective borrower must provide the exhibition conditions in a report form). Only when it has been determined that the conditions are suitable will the loan request be approved. The lending contract template provided by the German National Library contains binding provisions concerning climate conditions, insurance policies, etc. The same applies in the case of lending contracts for the purposes of digitalisation.

5.5. Preventive conservation of physical media units

Owing to the many millions of objects requiring preservation, double copies must be used to set priorities with regard to handling. The resources are not available to implement collection preservation measures to the same level of quality at both sites. Yet the basic principle still applies that preventive measures in particular are used to the same degree at both sites. For historic reasons, the Leipzig site houses the older collections, which is why the organisation of the collection preservation work is predominantly coordinated from there. For these same reasons, interventional measures at the German National Library are preferably carried out in Leipzig; in Frankfurt am Main, such measures focus on the collections of the German Exile Archive 1933–1945 and any works not held in Leipzig. These are primarily print media (books, newspapers, magazines) and, to a lesser extent, data and sound carriers made of various materials (records, cassette tapes, microfilms). In this context and in addition to such analogue media, there are also digital media on physical carriers (CDs, DVDs), yet also museum items of cultural heritage that are made of other types of material.

5.6. Mapping of the stacks

Department BE.1 is currently mapping the condition of the entire collection in order to gain an overview of the condition of the holding groups and derive a targeted action plan. Such status assessments are a vital prerequisite to a systematic collection preservation strategy. Some have already been drawn up for individual areas, but are now to be expanded to include the collection as a whole. Specially tailored data-capture and evaluation software is being used to create the condition map.

5.7. Mass de-acidification

Media works under threat from acid are de-acidified as early as possible.

The German National Library adheres to the currently applicable quality standards in its mass de-acidification procedure.

We de-acidify those of our collections under threat from acid in order to preserve them for as long as possible

Acid-containing collections are systematically tested for their acid content on a sample basis and included in the prioritisation catalogue for de-acidification measures.

Using the currently applicable standards, de-acidified collections are regularly tested on a sample basis in terms of the long-term effects of de-acidification.

Tests are carried out on a sample basis every five years to examine how previously de-acidified collections are developing.

The de-acidification measures are applied to all of those collections in the German National Archive under threat from acid. The collections are de-acidified in Leipzig, as media have been collected for longer at this site.

De-acidification is the primary procedure used at the German National Library in order to preserve the physical existence of threatened and damaged collections. This is because many objects held by the library date from an era when acidic glue and wood-pulp paper were used and are therefore exposed to the threat of damages caused by acid and accelerated ageing processes.

Virtually all of the holdings from the start of the library's collection mandate in 1913 through to the 1980s are fundamentally under threat from paper degradation caused by acids. Owing to the various degrees of damage, not all works can be treated at once and priorities must therefore be set. In general, large self-contained holding groups are selected that are structured around the library's collection procedures. Individual objects within these collection groups are tested to determine whether de-acidification is actually necessary, and which media are already so damaged that they can no longer undergo the requisite de-acidification processes.⁴ Tests are also conducted to assess whether the condition of the paper even allows for de-acidification measures to be carried out.

Calls to tender are issued for the de-acidification measures, and contracts are awarded for limited periods of time. A fixed workflow is in place for the actual de-acidification procedure.

⁴ These media are included in the digitalisation workflow in order to secure the information they contain. They are then packaged and sealed in order to signal that these are badly damaged media. These media are no longer lent out.

5.8. Archiving and maintenance of the collections

We archive our collections in accordance with the principles of collection preservation

The library uses packaging types developed in accordance with the current applicable standards and guidelines.

Harmful materials that are not part of the object (such as plastic covers) are removed before archiving.

Large formats from 35 cm upwards are stored in a prone position wherever possible.

Collections in the stacks are dry-cleaned on a regular basis according to a fixed order of priority.

Shelves are regularly cleaned using the least possible amount of fluid.

Owing to the vast quantities involved, the professional archiving and maintenance of the collections poses a great challenge. Cardboard storage receptacles are procured across both sites; this is overseen by Department BE.1.

The principle of “preservation in the original condition” leads to an increased quantity of unbound collections. If the objects are made available for use, they are frequently offered to users as individual editions or loose-leaf collections / in various packaging formats. In certain cases, it must be decided whether users should be required to work at a special workstation (theft prevention).

The collections at both sites – though hitherto predominantly at the Leipzig site – are regularly examined and cleaned where necessary. Established procedures are in place for this.

5.9. Insect monitoring

The rooms at both sites are regularly examined for insect infestations. This measure is carried out as part of the mapping of the stacks, during which process insect traps are set out in appropriate locations and regularly assessed.

5.10. Digitalisation of printed materials and data-carrier migration

We digitalise our collections in a way that preserves them

Ahead of any digitalisation measures, collections are assessed by Department BE.1 to see whether they are “fit for digitalisation” and then documented.

Department BE.1 implements measures to prevent any damage during the conversion process.

All the parameters involved in digitalisation, such as the opening angle, lighting, the influence of heat and mechanical stress, are selected in such a way that the object is exposed to the least-possible amount of interference.

Following each measure, Department BE.1. examines and documents the state of preservation of the collections and individual objects on a sample basis.

Digitalisation is a measure designed to secure information and which is above all used with objects that can no longer be preserved using any other measure. However, digitalisation cannot replace an original. It can be used as a collection preservation measure when objects are already damaged, yet not to such an extent that they are classified as a loss.

In the case of electronic publications issued on data carriers and delivered to the German National Library, migrating the data to mass memory devices is a necessary prerequisite to implementing digital preservation measures. This process also simplifies the provision to users, which is why data-carrier migration is a useful step for such media regardless of the level of threat the original data carrier is exposed to.

Owing to the German National Library's legal collection and preservation mandate, great priority is placed on preserving the original physical copies. In cases where the work required to preserve an original copy cannot be performed, the information is backed up on replacement media – previously on microfilm, now as a digital copy – for reasons of collection preservation. This replacement medium is provided to users instead of the original. The original is completely withdrawn from use or is only offered in exceptional cases.

A standard procedure has been developed for digitalising book-based objects at the German National Archive. The starting point for this was the digitalisation of damaged and no-longer-usable media (monographs and periodicals) in Leipzig. Between 2011 and 2016, the content of around 38,000 book-based objects was secured and made accessible to users once more.

A quality-management procedure is in place for digitalisation measures to ensure adherence to the principles of collection preservation. This forms part of the procedure for digitalising damaged book-based media.

5.11. Conservation- and restoration-based collection preservation measures

We handle our collections in accordance with conservation guidelines on collection preservation

In principle, each object should be preserved in its original condition.

All measures are performed in as minimally invasive a manner as possible.

All measures must be reversible to the greatest practicable extent.

All materials used meet the current conservation requirements.

The measures are documented as much as possible.

Stabilising conservation or restoration measures are carried out within Department BE.1 in order to secure, or prevent the loss of, damaged original parts and to enable the objects to be used. All measures are performed in accordance with the principle of minimal invasiveness. This means that interventional measures interfere with the original substance as little as possible, yet as much as necessary.

The systematic work performed on the collections focuses on conservation-based preservation measures. These are measures that prevent the loss of information (for example, parts that are falling off the object, torn/loose pages, etc.) and are as non-invasive as possible. The conservation-based preservation measures are not performed on individual items, but on holding groups as a whole. Unlike restoration-based measures – which can involve highly complex tasks and at-times intricate restoration processes on each object, and are therefore considerably more time-consuming – these measures are to be regarded as mass-treatment processes used on large quantities of objects at once. The precise quantity to be treated in each instance depends greatly on the level of damage and the available capacity. In principle, these measures involve relatively small object quantities compared to purely machine-based mass-treatment processes with a single intervention parameter, such as mass de-acidification, the nature of which allows for much greater quantities to be treated at once.

With the special collections, the Preservation Department works with the respective collection's directors to create a priority list for treating the collections. Here too, the principle of minimal invasiveness applies when using conservation-based preservation measures, though these may differ from the measures used for the general collection owing to the make-up of the respective special collection.

The current standards in restoration ethics, such as the [E.C.C.O. Guidelines](#), are adhered to as far as practicable in mass-treatment processes.

5.12. Binding measures for objects in the collections

Binding measures for objects in the collections are only implemented when, owing to the condition of the respective object, the original is likely to suffer damage when being used or archived and that damage can be reduced or avoided through binding.

Binding measures are implemented in two different ways:

a) Outsourcing

For this purpose, an annual call for tenders ("Binding work") is issued jointly by the two sites. The call to tenders outlines the required binding tasks in accordance with RAL regulations and DIN 33902, as well as defined conservation specifications.

b) Internal processing

Owing to the available resources, alternative storage options in protective formats made of acid-free and ageing-resistant material in accordance with DIN ISO 16245-A are used (predominantly in the form of archive-appropriate cardboard packaging).

In combination with other detailed regulations, the binding principles followed in Leipzig and Frankfurt am Main stipulate which media are handled by external contractors and which processed internally.

5.13. Exhibitions

The presentation of original objects in exhibitions is planned in coordination with the directors of the respective collections and Department BE.1. Depending on the fragility of the objects and the nature of the exhibition space, certain guideline values for the objects must be adhered to. These guideline values must be determined together with Department BE.1. before exhibition planning begins.

The duration of the objects' exposure in exhibitions is determined in advance in collaboration with Department BE.1. and depends on how fragile the objects are.

In the case of exhibitions with external partners, the conditions of the exhibition are determined and coordinated with BE.1.

Borrowers must provide information about the exhibition parameters and ensure that the conservation of the objects is monitored.

Before and after the museum lends out its own objects, Department BE.1. creates a status report and monitors the objects' condition, especially in the case of extended exposure.

5.14. Documentation of collection preservation measures

Collection preservation measures are recorded in a custom-programmed, web-based form. The entries appear as defined codes in the copy data record. This makes it possible to filter in a targeted manner according to specific or necessary measures.

6. Long-term preservation of digital media

6.1. Background

In line with its legal mandate, the German National Library utilises processes for long-term preservation (LTP) in order to preserve its digital collections and maintain their accessibility and utility for the long term, i.e. for an indefinite period and regardless of technological changes. The key principles of digital preservation at the German National Library are published in its LTP Policy, last updated 04.05.2018⁵. The policy also defines the different roles and responsibilities involved: The Domain Information Infrastructure is responsible for digital preservation.

Guided by the procedures established for this purpose, the German National Library determines between so-called online publications (non-physical media works from public networks, such as online dissertations, e-books, e-journals, e-papers, audio books) and other object types:

- | Archival copies of websites from the selective crawl (currently only partially stored in the storage infrastructure of the German National Library)
- | Domain crawl of the “.de” domain (currently not yet stored in the storage infrastructure of the German National Library)
- | Digital copies of the library's own collections, including digitalised tables of contents
- | Digitalisation results from other libraries
- | Migrated audio CDs and digital copies of other sound carriers
- | Disc images created in the course of data-carrier migrations

The number of genuinely digital media collected at the library has been growing continuously over the years and now annually exceeds the number of print copies received. Current data regarding accessibility and holdings can be found in the “Facts + Figures” section of the German National Library's annual report⁶.

In conceptual terms, multiple copies of all legal deposit objects of the German National Library must be stored for reasons of security and accessibility. Firstly, the data at the German National Library are stored in a local storage infrastructure optimised for accessibility. Secondly, the data are transmitted to koala, the long-term preservation system operated by an external service provider (Gesellschaft für wissenschaftliche Datenverarbeitung Göttingen, GWDG), which is located in Göttingen and therefore geographically separated from the sites of the German National Library in Frankfurt am Main and Leipzig. Here the data are stored in accordance with the stringent

⁵ <https://nbn-resolving.org/urn:nbn:de:101-2018051803>

⁶ <http://www.dnb.de/DE/Wir/Publikationen/jahresberichte.html>

requirements for long-term preservation. The long-term preservation system supports preservation measures such as migration into new formats.

Searches and access are organised via the catalogue system, which provides a link to the respective document in the local storage infrastructure of the German National Library.

The number of terabytes taken up by the current holdings is in the triple digits.

It is predicted that the quantities of data in all the above-named areas will continue to increase, so that the amount of available capacity in both organisational and financial terms must be continuously monitored and expanded.

At the same time, work is being conducted on improving the division of work between the local storage infrastructure and the long-term preservation system, so that the data can be stored in an efficient and needs-based way. A needs-based caching strategy that meets the demands in terms of both provision and long-term preservation must be evaluated and established.

6.2. Long-term preservation in the workflow for online publications

Online publications are delivered to the German National Library via various interfaces. A core set of metadata accompanies the publications via all delivery interfaces. These are converted into catalogue entries using an automated process. No manual cataloguing of online publications takes place. These metadata contain no specific information for long-term preservation. In parallel, the objects also enter the repository of the German National Library. In the process, technical metadata important to the long-term preservation process are generated. An automated risk analysis is also conducted. The aim of the risk analysis is to create so-called ingest levels, which use various criteria to evaluate the collected objects' suitability for long-term preservation.

In a separate workflow, the objects are also transmitted to the externally hosted long-term preservation system. Users access the objects via the local repository, i.e. not directly from the long-term preservation system but instead using the German National Library's own infrastructure, which holds the corresponding user copy. In the event that an object stored in this environment is not usable, a usable copy is requested from the long-term preservation system and in a new data format if necessary.

As the German National Library seeks to preserve digital media as authentically as possible, it currently eschews format conversions during the ingest in the online publications workflow.

6.3. Long-term preservation in the workflow for other digital object types

Alongside the digital objects that enter the repository and long-term preservation system via the specific ingest-workflow for online publications, additional digital objects are also held in the German National Library. In contrast to the collection of online publications, these objects are currently not yet transmitted to the external long-term preservation system. The requisite workflows must be established in the short and medium term.

6.4. Long-term preservation in the AREDO workflow

Given the quantity and diversity of digital media received by the German National Library via a whole variety of procedures, the library seeks, among other things, to create collaborative structures in digital preservation in order to facilitate a holistic collection preservation policy. For this reason, the German National Library has been additionally operating the collaborative service "Archiving and permanent preservation of digital objects" ("Archivierung und dauerhafte Erhaltung digitaler Objekte", AREDO) since 2014. As Germany's central archive library, the German National Library supports selected institutions in maintaining the accessibility of their digital information. In order to purposefully achieve synergies between all participating collaboration partners while adhering to economic framework conditions, work is performed at the practical level to further the development of solutions, concepts and processes in digital preservation.

For this reason, existing technical and organisational structures within the German National Library must be continuously adapted to the various requirements.

6.5. File formats, copy protection and validation

The German National Library fundamentally collects digital publications in the format they are published in. Preferences are currently being announced for instances where publications with the same content are issued in different formats; in such instances, objects in PDF or PDF/A format are preferred. To date, just under 50 different file formats have been recorded and validated during the ingest-workflow for online publications. An evaluation of the entire collection showed that over 99% of the objects are available in the five most common file formats:

1. application/pdf
2. audio/mpeg
3. image/jpeg
4. application/epub+zip
5. text/xml

File formats	Percentage of total amount
application/pdf	63.0779%
audio/mpeg	18.3892%
image/jpeg	7.2963%
application/epub+zip	6.7999%
text/xml	4.2980%

In total, the remaining file formats make up less than 1% of the entire collection; these include many so-called "appendices", which are not main components of the respective publication. However, reliable automated preservation planning is not possible for all of these formats; it is already impossible to guarantee the accessibility of all these formats.

With regard to long-term preservation, it is essential that sufficient technical metadata can be generated for each file format. The ingest-workflow for online publications ensures that this is the case for the most common file formats. The regular monitoring and expansion of generation processes for existing or additional file formats must be continuously pursued.

It is also vital that the publications are delivered without technical protection measures. The supplier is therefore required to supply files without any protection measures in place. Whether or not files are unrestricted is determined during the ingest process. Protected documents are rejected and the supplier is asked to send a replacement copy.

6.6. Long-term preservation system

For digital objects that have been collected in accordance with the German National Library's legal mandate, a long-term preservation system (koala) is in operation that facilitates long-term preservation strategies in order to ensure the long-term interpretability of the stored objects. This long-term preservation system consists of different components, some of which are independent of one another: an import component; a storage component; an access component; a component that supports the migration of potentially threatened objects; and an administrative component.

The tasks of long-term preservation include not only maintaining the usability of the archived objects, but also continuously adapting the long-term preservation system to the changing technological conditions (cf. the [Preservation Planning Policy](#)).

6.7. Long-term preservation measures (for all object types)

The long-term preservation system's storage component must carry out certain processes to secure the bitstream preservation. These processes include the creation of a regular backup with a recovery concept, multiple storage in geographically separate locations, and a regular error-check of the primary data carrier.

The exact requirements that a service-provider must meet for these processes – which also fundamentally apply for the German National Library and its internal memory systems – are documented.

Alongside the above-described preservation at the bitstream level, a key task is to ensure that the data can still be interpreted despite changing system environments. Two processes are commonly used for this purpose (long-term preservation strategies):

1. Migration: The file format of the digital object is converted for use in the display programs available in the current system environments.
2. Emulation: Special emulation software is used in a current system environment to reconstruct an older environment in which the digital object can again be used.

Both of these processes are complex and entail a risk of unintentional or unnoticed information loss. However, it must be assumed that every digital object will at some point become unusable (i.e. people can no longer access its content) without additional measures – even if the bitstream can be maintained – if none of these processes are used. The processes have advantages and disadvantages depending on the type of digital object. Both processes are used for the collections of the German National Library.

As there is no wide-ranging experience in the use of these processes, the practical view regarding the existing digital objects is that migration represents the most efficient process for static objects such as images and texts, whereas emulation is necessary for executable programs (such as multimedia CD-ROMs). To assess these processes and the continuous progress made in this area, it is necessary for employees of the German National Library to regularly engage in dialogue with other institutions nationally and internationally at conferences such as iPRES (International Conference on Digital Preservation) and as part of nestor (network of expertise in long-term storage of digital resource). Research and development projects and collaborations with national and international partners also serve to involve the library in the progress made in this area.

In preparation for future migrations, an internal working group has begun to develop theoretical considerations regarding the definition of so-called preservation groups, using the existing object groups as guidance. The key element of this work is the definition of significant properties that must be preserved every time digital objects are migrated. When a migration becomes necessary, these considerations must be aligned with the technical framework conditions.

The existing long-term preservation system supports original format migration strategies. This was demonstrated during the kopal projects, yet was not designed for regular functional operation. Even in the absence of a specific need, it is therefore important in the short and medium term to design and implement a pilot project for file-format migration in order to expose previous assumptions to real-world testing.

In order to integrate the emulation strategy for the provision of multimedia objects in particular, the system developed in the EMil project funded by the DFG is being transferred into the infrastructure of the German National Library.

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