DELIVERABLE

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D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks

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CONTENT TABLE

0. Executive summary

This deliverable *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks* builds on the previous deliverable, *D4.1 Digitisation workflow description for digitising the selected artworks*. The latter was designed as a practical and useable guide, containing both the steps to follow and the technical parameters for the digitisation of selected artworks (and contextual documents).

D4.1 Digitisation workflow description for digitising the selected artworks was a document for internal use only, targeting the content partners of the DCA project. This deliverable *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* has a broader target group, as it is designed to be public. Its aim is to produce a set of guidelines that could serve as a reference for collection caretakers (in- and outside museums) when they start digitising a collection of contemporary artworks.

Apart from the difference in target group, another major difference between *D4.1 Digitisation workflow description for digitising the selected artworks* and *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* is the fact that the latter is enriched with the results of a survey that was sent out to the content partners of the DCA project in month19 (see Annex III).

That survey asked the content partners to provide work package 4 with feedback concerning *D4.1 Digitisation workflow description for digitising the selected artworks* and how it had been useful to them, as well as the practical problems they have encountered in the course of the process of digitising their collections. This feedback has been included within *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks*, along with remarks that were made within the European Commission's Technical Review Report of the Intermediate Review Report (6 July, 2012).

Finally, *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* also benefits from the support of a Media Art Group that was set up among DCA partners within the course of the project with the aim to add specific content about the digitisation of media artworks.

This deliverable underlines that digitisation does not only mean the actual conversion from analogue to digital, but refers to the whole chain of actions, from determining the initial digitisation goals and creating a digitisation plan to the actual quality control of the resulting digital files. However, some of the steps that are important to a digitisation process were only touched upon briefly since they form the subject of other work packages of the DCA project.[1]

D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks starts with outlining the different steps in the digitisation process, which are then elaborated upon in detail. When discussing some of the steps, reference is made to *Annex I of the Grant Agreement nr. 270927* since decisions about certain aspects of the workflow were already made and consolidated in it prior to the actual start of the DCA project (e.g., relating to selection of the artworks and contextual documents, determining digitisation goals, clearing copyright and to a certain extent the analysis of the artworks and contextual documents to be digitised).

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[1] For instance the guidelines on aggregation and long-term preservation of digital files are part of the work to be carried out in the DCA work packages 5 and 6.

After completing the preparatory phase, quality parameters need to be decided upon. In the section about the conversion from analogue to digital (the actual digitisation), different best practices concerning the choice of the file format, resolution, bit depth, colour profile, are listed for the various types of artworks (and contextual documents) that are part of the DCA content selection (e.g., paintings, photographs, sculptures, installations and audio-visual works). The technical specifications are matched to practical workflows per file type so they can be put into practice easily. After the digital conversion, quality control precedes the creation of derivative or access copies. Thorough quality control is crucial since it does not only refer to the quality of the digital files that were produced, it is also important for the long-term preservation of the files. As one of the goals of the DCA project is to make digital reproductions available online (including on the *Europeana* portal), the creation of derivative or access copies of the digitised objects concludes the workflow.

One step that is particularly important in an encompassing digitisation workflow is the creation of a detailed digitisation plan, which is paramount to ensuring a good input/output ratio and high quality results. It is also a valuable tool for both the content partners and the DCA project leader for the accurate monitoring of time and means. A template for such a plan was issued by DCA's work package 2 and completed by all content partners. The digitisation plan template is incorporated in this deliverable as an annex (Annex I: Digitisation plan).

1. Introduction

The deliverable *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* is a practical document that can be used by all collection caretakers (in- and outside museums). It gives guidelines and provides parameters for the digitisation of a collection of contemporary artworks and contextual documents. Although within the art world, 'contemporary' refers more to a style than a chronological landmark, within the DCA project we refer to 'contemporary artworks' as works that have been produced since 1945, no matter their type or the means that were used to create them. This does not imply any restriction, as the lists provided by the DCA content providers include work dating from the late 40's to the present. *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* therefore applies to a broad range of artworks: paintings, sculptures, works on paper, media artworks, installations, …

Often digitisation is understood as just being the conversion of an analogue information object into a digital format. However, digitisation is more than just the technical conversion from analogue to digital. Digitisation is a process that involves various stages. It starts with determining digitisation goals, then proceeds with the selection and the preparation of the artworks or contextual documents, the definition of the quality parameters, the actual conversion from analogue to digital, the quality control of the digital files, the long-term storage, and ends with making the digital content accessible. The basic assumption of this chain of actions should always be the preservation of the intrinsic value of an artwork or contextual document.

The DCA project aims to create digital contemporary art content that is as widely useful, portable[2] and durable as possible. Since one of the main results of the DCA project has been the online accessibility of digital content through *Europeana*, digitisation requires that the resources and content are interoperable with any other content that is present, for instance in the *Europeana* portal or the aggregators delivering content to the portal. According to MINERVA, ensuring this 'interoperability' involves:

> - consistency of approach to the creation, management and delivery of digital resources through the effective use of standards, rules and good practice guidelines;
> - making content available to a range of services through the use of internet protocols and APIs (Application Programming Interfaces).[3]

The adoption of a shared set of technical standards and guidelines has been considered an important step to ensure the same-level conformity of all DCA partners to the project goals.

The digitisation workflow description is based on the digitisation expertise of the DCA partners and will help collection caretakers with less experience in digitisation. It can be used as a step-by-step guide through the various stages of the digitisation process. The digitisation workflow description has given the DCA project a working frame to which all partners can refer at any stage during the lifetime of the project. We hope that *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* will broaden the scope of the beneficiaries of this experience to other caretakers of contemporary art collections.

As mentioned above, the scope of the DCA project is very broad in terms of materials and techniques. However, the DCA consortium[4] thinks that the artworks (and contextual documents) to be digitised can roughly be divided in three groups:

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[2] Usable on many computers (with different operating systems and application software installed).
[3] MINERVA, *Technical Guidelines for Digital Cultural Content Creation Programmes (Version 2.0)*, 2008, p. 9-10, http://www.minervaeurope.org/publications/MINERVA%20TG%202.0.pdf
[4] The members of the DCA consortium are argos - centre for art and media (Belgium), ARS Electronica (Austria), European Media Art Festival (Germany), Frissiras Museum (Greece), Fundação Serralves (Portugal), Fundació Antoni Tàpies (Spain), iMinds (Belgium), Latvian Centre for Contemporary Art (Latvia), Macedonian Museum of Contemporary Art (Greece), Mu.ZEE (Belgium), Museum Boijmans Van Beuningen (the Netherlands), Museum of Contemporary Art Grand-Hornu (Belgium), Museum of Modern and Contemporary Art (Croatia), Museum of Modern Art (Slovenia), National

1/ artworks (and contextual documents) for which the digitisation results will be an image file – this group consists of for instance paintings, drawings, photographs, text documents, artist books, sculptures and installations;

2/ artworks (and contextual documents) for which the digitisation results will be a moving image file – this group mainly consists of video works and documents;

3/ artworks (and contextual objects) for which the digitisation results will be an audio file – this group mainly consists of audio works and documents.

Within the DCA project, the (audio-visual) artworks and contextual documents that cannot be digitised through digital reproduction photography form a small but important minority.

For the digitisation of the first group of artworks this deliverable *D4.2 Guidelines for an A-Z digitisation workflow of contemporary art works* focuses on digital reproduction photography and, to a lesser degree, on scanning. Digital reproduction photography is not the only digitisation option when working on a collection of for instance paintings, photographs, text documents, sculptures, works on paper and installations; one could, for instance, also consider using a scanner for art works on paper. However, we believe that digital reproduction photography it is the best way to reach a high level of quality for all DCA partners. In the digitisation workflow description of this deliverable *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* the process of scanning is only described as a technique to digitise text documents, photographs or slides.

The American National Information Standards Organization (NISO) has enlisted the following facts regarding digitisation:

- digital programmes provide the framework that brings together people, policies and tools;
- digital collection-building programmes have become a core part of many organisations' missions, but this may not be reflected in the organisational structure and funding;
- a key component of the digital programme manager's job is ensuring that the core nature of digital collection building is explicit at every level of the organisation;
- building a digital collection often involves assembling a team of individuals from various disciplines, departments, and/or institutions: team building![5]

NISO has also enlisted some simple principles that are worth following:

- a good digital initiative has a substantial design and planning component;
- a good digital initiative has an appropriate level of staffing with necessary expertise to achieve its objectives;
- a good digital initiative follows best practices for project management;
- a good digital initiative has an evaluation component;
- a good digital initiative markets itself and broadly disseminates information about the initiative's process and outcomes;
- a good digital initiative considers the entire lifecycle of the digital collection and associated services.[6]

As the work package list of the DCA project shows, these principles have been implemented in the project:

Gallery - Alexandros Soutzos Museum (Greece), National Gallery of Iceland (Iceland), National Technical University of Athens (Greece), Netherlands Media Art Institute (the Netherlands), PACKED vzw – centre of expertise in digital heritage (Belgium), Reykjavik Art Museum (Iceland), Royal Museums of Fine Arts of Belgium (Belgium), Staatliche Hochschule für Gestaltung (Germany), Transmediale (Germany), Ubitech (Greece), WRO Art Center (Poland). For further information, see http://www.dca-project.eu/about
[5] NISO, *A Framework of Guidance for Building Good Digital Collections*, 2007, p. 91, http://www.niso.org/publications/rp/framework3.pdf
[6] Idem.

- work package 1 (Project management) and work package 2 (Partner coordination and technical specifications of collections) cover all planning, management and evaluation issues;
- work package 4 (Digitisation – supervision) covers the issues related to the expertise, the objectives and how to reach them;
- work package 3 (Metadata requirements for digitising and archiving contemporary art), work package 5 (Preparation, aggregation and ingestion of content) and work package 6 (Long-term sustainability – guidelines for long-term preservation of digital files) cover the issues related to the lifecycle of the digital collection;
- work package 7 (Dissemination) fulfils the need for DCA to disseminate information about the project's process and outcomes.

The different steps in the digitisation process which are covered by this deliverable *D4.2 Guidelines for an A-Z digitisation workflow of contemporary art objects* are:
1. determining digitisation goals;
2. creating a project plan;
3. defining the selection of the artworks (and contextual documents);
4. clearing copyright;
5. analysing the artworks (and contextual documents) to be digitised;
6. preparing the artworks (and contextual documents) to be digitised;
7. defining the quality parameters;
8. digitisation;
9. digital restoration;
10. quality control;
11. creating access copies;
12. submitting the digital files to the digital archive;
13. making the digital files available for online access.

2. Determining digitisation goals

2.1. General digitisation goals

The first thing that every collecting institution (museum or other) needs to do is to outline the goals and scope of its digitisation activities.

In general the goals for a digitisation project are:
- preservation: digitisation for preservation purposes means that artworks (or contextual documents) will be digitised to prevent decay or further quality loss. Some (e.g., audio-visual artworks) suffer from the rapid decay of their carrier (e.g., magnetic tape). Consulting, manipulating or exhibiting the works (or contextual documents) can also result in carrier damage (e.g., works on paper) and thus loss of content;
- access: often it is impossible or very difficult to consult some artworks (or contextual documents) in their original (analogue) form. Many of them are not exhibited permanently but stored in warehouses. Some of them even require a complex assembly and installation process (e.g., installations), others require expensive playback and display equipment. Digital reproductions can be accessed and distributed easily;
- substitution: although collecting institutions usually want to keep the original object, it might be possible that it is digitised because the digital reproduction needs to substitute the analogue original (e.g., an audio-visual art work or document on an obsolete magnetic tape format);
- restoration: digital techniques can help to restore an analogue artwork (or contextual document) (e.g., photographs, films, videos…). In such cases the collecting institution will first have to digitise the analogue original;
- valorisation: artworks (or contextual documents) might have a commercial value for the collecting institution. In such cases the institution might decide to digitise certain parts of its collection to create a financial income through digital reproductions;
- promotion: it might be interesting for a collecting institution to digitise certain masterpieces of its collection in order to promote the institution. Such promotion may bring a larger number of visitors or stronger support from funding bodies and policy makers;
- findability: digitisation makes it easier for the different user groups to find contemporary art – especially if the metadata and digital reproductions are available on the websites of the collecting institutions and on popular portal sites like *Europeana*.

Often digitisation projects combine or aim for several digitisation goals at the same time, while one goal may be considered more important than another. The main digitisation goals are preservation and access. Substitution and restoration are linked to preservation; valorisation and promotion are linked to access.

A distinction can be made between the preservation of the content and the preservation of the original item. For film and video the content will often be lost without digitisation due to the rapid decay of the carrier. The value often lies in the content that is stored on the carrier, and not in the original film or video item (i.e., the carrier) itself. In this case another format and carrier can substitute the original one as long as the content is preserved. In other cases the collecting institution would still prefer not to substitute the original audio-visual format and the carrier because the item itself has a value (e.g., when the videotape is signed by the artist), the format and carrier are part of the meaning of the work, or the artist does not allow it and prefers his/her work to be shown as an analogue film and not as a digital video… For works on paper or canvas providing an alternate mode of access often enables the preservation. In this way the original item can be stored in the most beneficial preservation environment possible.

Here the value usually not only lies in the content, but also in the original item. Note that creating enriched metadata about the content, provenance and status of the artwork through digitisation (or prior to the process itself), can also be regarded as a preservation measure, as more information about the artwork or document could also result in a better preservation of it.

The creation of digital reproductions to produce exhibitions, catalogues, prints and merchandising is for most collecting institutions a major drive for digitisation investment. One should also underline the importance of the 'access' factor (digitising to give access to artworks and/or contextual documents) when it comes to works on paper (e.g., artist books or drawings) and archival documents.

It is clear that the goals of the DCA project as defined in *Annex I – Description of Work to the Grant Agreement 270927* meet these general digitisation goals in various ways:
- to enlarge the presence of contemporary art in *Europeana* = *promotion*;
- to improve the preservation of the selected contemporary artworks = *preservation*;
- to increase accessibility of contemporary artworks in general and to enhance the accessibility and retrievability by delivering digitised content to *Europeana* = *access*.

2.2. Some examples

The *Digitisation Guide – A simple guide to digitisation for museums* presents the following examples of digitisation purposes:
- making a collection accessible to those who cannot visit the museum;
- responding to proven audience requirements;
- for the production of a new book;
- for the production of a CD-ROM or website;
- to reduce the handling of fragile originals;
- to take advantage of the opportunity brought by a regional digitisation project;
- as part of a conservation project;
- to provide content for an exhibition;
- to contribute to a learning package or provide e-learning opportunities.[7]

The general digitisation goals are reflected in this list:
- to digitise artworks "to reduce the handling of fragile originals" could be considered as preservation;
- "making a collection accessible to those that cannot visit the museum" could be considered as access;
- "for the production of a CD-ROM or website" could be considered as promotion (of the collection).

An example of substitution might be the digitisation of old analogue videotapes. Their formats have often become obsolete, and to save their content they need to be digitised. To restore a photograph it might be necessary to first digitise the analogue photo print or film negative to be able to use state-of-the-art restoration software. An example of valorisation might be the digitisation of artworks to commercialise their digital reproductions through merchandising.

2.3. Digitise once for all purposes

In general we recommend that caretakers of contemporary art collections define their

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[7] RENAISSANCE EAST MIDLANDS, *Digitisation Guide – A simple guide to digitisation for museums*, p.4, http://www.mla.gov.uk/what/programmes/renaissance/regions/east_midlands/info_for_sector/~/media/East_Midlands/Files /2009/Renaissance_Digitisation_Guide1

digitisation goals as broadly as possible: *"A good baseline to create a digital file that will be long-lasting would be Scan Once for All Purposes – this means that all the complex and expensive preparation work will only need to be done once."* [8] This *Digitise Once for All Purposes* approach is especially recommended for the digitisation of

- artworks that need to be assembled or/and installed for the sole purpose of digitisation;
- artworks (and contextual documents) that are vulnerable;[9]
- artworks (and contextual documents) that are stored on a carrier that is obsolete or is becoming obsolete;
- artworks (and contextual documents) that are stored on a carrier that is subject to rapid physical decay;
- artworks (and contextual documents) that require digital reproductions in a different file format, resolution or quality.

It is clear that the digitisation of artworks provides many advantages to collection institutions, but one should not forget that digitisation also creates some pitfalls. Collecting institutions will become dependent on software and hardware, and these rapidly become obsolete. Digital files that can be easily accessed today might be inaccessible in ten years time due to rapid technological evolution. This means that collecting institutions need to take certain measures to assure the long-term preservation of digital content. Within the DCA project these measures have been discussed as part of work package 6 (Long-term sustainability – guidelines for long-term preservation of digital files). This resulted in the deliverables *D6.1 Guidelines for a long time preservation strategy for digital reproductions and metadata* and *D6.2 Best practices for a digital storage infrastructure for the long-term preservation of digital files*.

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[8] HEDS, *The Digitisation Process*, 2004, http://www.ukoln.ac.uk/nof/support/gpg/DigitisationProcess/
[9] For instance artworks and contextual documents on paper.

3. Developing a project plan

3.1. Estimating the costs and duration of the digitisation project

It is important to estimate the costs and duration of the digitisation project in advance. In the case of the DCA project the costs and duration of the project were already determined prior to the actual start of the project.[10]

The better the digitisation process is prepared, the smoother the digitisation procedure will be. Unfortunately it might sometimes be difficult to estimate the cost and duration of the preparation stage. Some reasons for this might be:
- the copyright situation (tracing rights holders, negotiating license agreements, …);
- the condition of the collection (especially for audio-visual works: before digitisation one might need to clean magnetic tapes, restore audio reels, …);
- the selection (especially for audio-visual works: one might need to compare different copies or versions, …);
- the enrichment of the metadata:
- the transport and installation of the artworks for digitisation;
- the changing prices of hardware and services.

3.2. Writing a digitisation plan

3.2.1. The content of the digitisation plan

A detailed digitisation plan is paramount to ensuring a good input/output ratio and high quality results. In the DCA project, work package 2 issued a template for such a plan that would give a more detailed picture for the preparation of digitisation in each collecting institution. The template can be found in Annex I: Digitisation plan.

In general, a digitisation plan should provide for the following information:
- the digitisation goals;
- the target audience;
- the envisaged end result.
The digitisation plan template used in the DCA project describes the aims, actions and results expected, the items to be digitised and the workflow. The target audience was not described in the DCA plan since it was already defined in *Annex I – Description of Work to the Grant Agreement 270927*. [11]

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[10] The DCA content partners could not make digitisation costs that did not correspond with those included in *Annex I – Description of Work to the Grant Agreement 270927*. If a DCA content partner noticed that the actual digitisation costs differ from those listed in *Annex I – Description of Work to the Grant Agreement 270927*, it had to contact project leader PACKED. If it noticed that the digitisation procedure was slower than planned and that there was a risk that the deadlines that had been agreed upon by the DCA consortium could not be respected, it also had to contact project leader PACKED.

[11] The digital reproductions and its metadata are likely to be of particular interest to:
- the members of the general public, especially but not exclusively those interested in contemporary art;
- other more specialised users:
    ° mediators between the general public and the artwork and artist, like art critics, publishers, ...;
    ° users from the educational field, like teachers, students, ...;
    ° users from the research field., like art historians, philosophers, ...;
    ° professionals in the arts field, like museums workers, guides, ...;
    ° artists;
- users from the broader field of tourism, IT technology, marketing, creative design,...;

A digitisation plan could contain the following elements:[12]

- an introduction (for example explaining what made the institution decide to start digitisation);
- a global description of the institution's collection;
- a short description of the part of the institution's collection that is to be digitised;
- a description of the part of the collection to be digitised;
  ° the material;
  ° the size;
  ° the amount and quality of the metadata;
  ° additional documentation;
  ° the target audience(s);
  ° the availability of analogue reproductions;
  ° the availability of collection parts that are already digital;
- the priorities and different stages of the digitisation project;
- the digitisation method (describing the technical process and encompassing workflow);
- the quality assurance and benchmarking;
- the quality evaluation;
- the method employed to make digital content accessible (for example on the institution's website, or – in the framework of the DCA project – on the *Europeana* portal);
- the digital sustainability;
  ° the composition of the digital collection;
  ° the strategies for digital sustainability (for how long will you preserve the digital material? for what uses? in which quality?)
  ° the storage (in-house or outsourced?) and metadata;
  ° the organisation.

The digital sustainability of the content digitised as part of the DCA project was supported by the work to be done in the work package 6 that is devoted to the long-term preservation of digital content.

3.2.2. The digitisation plan as a monitoring tool

A detailed digitisation plan is a valuable tool for monitoring the quality of a digitisation process (in terms of for instance technical specifications applied), but also for monitoring the timing of the different steps that need to be completed in order to fulfil project goals. For this reason digitisation plans created by content partners as part of the DCA activities describe more than just the mere act of digital reproduction; they also include technical specifications and a timetable that depicts the entire workflow to be undertaken in the DCA project. The timetable allows for a monitoring of all the main stages of the digitisation process: the preparation of (analogue) works, the digitisation itself, metadata registration, the online display and aggregation to *Europeana*.

In general, the factors that need to be controlled and monitored during the digitisation process are:
- time (the envisaged duration of the process);
- quality (the envisaged digital end product);
- available means (in terms of budget, equipment, room or space, …);
- organisation (availability of staff, their internal structuring and technical competence);

- the collecting institutions (reproductions can be used for research, preservation, publicity, education, ...);
- *Europeana*.

[12] See http://www.den.nl/standaard/48/digitaliseringsplan

- information (internal discussion structure, communication about the project).

3.3. Deciding between in-house digitisation and outsourcing

3.3.1. General considerations

The crucial issue that follows the determination of digitisation goals is the decision between in-house digitisation and subcontracting. By in-house digitisation we mean that the digitisation is performed by the institution staff itself and therefore not by a subcontractor. A subcontractor, for instance a reproduction photographer, can also work on the premises of the institution.[13]

The decision to perform digitisation in-house or to outsource it usually depends on the following factors:
- the amount of material to be digitised;
- the vulnerability of the material to be digitised and the transport risks;
- the physical organisation of the collections (and the corresponding catalogues);
- the availability of skilled staff;
- the availability of equipment (hardware and software);
- the deadlines.

When making a decision between in-house digitisation and outsourcing, the collecting institution needs to balance advantages and disadvantages with care. Both in-house digitisation and outsourcing might have their own specific advantages or disadvantages.

3.3.2. In-house digitisation

A collecting institution will often decide to do digitisation in-house:
- when the digitisation project (and/or the amount of artworks and documents to be digitised) is relatively small it might be too burdensome to carry out a large digitisation project in-house, especially for small contemporary art institutions;
- when the digitisation project can be completed in a relatively short period of time - the longer a digitisation project lasts, the greater the workload;
- when there is already a sufficient amount of specialised knowledge and experience available within the institution or if the institution wants to acquire more of such;
- when the required equipment (hardware and software) is available in the collecting institution.

3.3.3. Outsourcing

Outsourcing requires great confidence in the subcontractor, especially if the artworks (or contextual documents) need to leave the premises of the collecting institution. It is very important to keep a track list when artworks (or contextual documents) leave the premises, even in the case of audio-visual artworks or documents. It is recommended to consider insurance for the artworks (or contextual documents) while they are in transit and at the contractor's base of operation. It is also recommended to find out whether the contractor can maintain the preservation environment (temperature and humidity) and the security that the collecting institution desires.

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[13] Within the DCA project we did not consider a subcontractor working on the premises of the institution as in-house digitisation but as outsourcing.

It is usually recommended to outsource the digitisation of audio-visual artworks and documents. The digitisation of audio-visual artworks and documents is a complex process that requires amongst others specialised knowledge and experience, a large amount of labour time, playback equipment in good condition for all formats to be digitised, a broad range of peripheral equipment (e.g., cleaning equipment for magnetic tapes), hardware and software to convert the analogue signal into a digital signal. The investment that is required to do the digitisation in-house will only save labour time and financial means in the long term for collecting institutions with large audio-visual collections. For relatively short-term digitisation projects such as the DCA project (thirty months), training staff will, for example, take too much time for the institution to be able to carry out digitisation in the given timeframe. Collecting institutions with a small audio-visual collection to be digitised should only consider doing this type of digitisation in-house if the collection contains a very limited number of formats and needs to be digitised for the sole purpose of access (which requires a lower quality than digitisation, for instance, for access purposes). Even this will become difficult if it concerns the digitisation of old analogue audio-visual works.

Outsourcing does not mean that the collecting institution should not still actively gain knowledge about the digitisation process. The collecting institution will need a certain amount of knowledge to be able to communicate about the project internally and externally, for example in negotiations with the subcontractor. The quality control must be carried out by the collecting institution as well as by the contractor. Carrying out the quality control in-house requires a certain amount of knowledge available in-house. Even if it is agreed that quality control is part of the subcontractor's work, the collecting institution should monitor its quality control. Otherwise, there is no means of validating the work before payment.

Quality control is not always simple: for example in relation to the digitisation of audio-visual works or documents, determining whether poor digitisation quality is the result of a poor service or of the poor condition of the analogue source material requires a certain amount of knowledge.

Benchmarks are important for the quality control. They are clear definitions of the minimum standards acceptable for a given project. Depending upon the type of project they may include, for instance, file formats, the minimum resolution of files or compulsory metadata values. They also make it possible to compare the quality of the output of one digitisation project to another, or of one project partner to another. Without benchmarks the collecting institution can hit the technical specifications and still not provide an adequate product. Benchmarks protect against specification drift.

3.3.4. Some recommendations in the case of outsourcing digitisation

Some recommendations in the case of outsourcing digitisation work:
- consider a pilot at the beginning to check the work of the subcontractor;
- do benchmarking - either in the selection of the subcontractor or as part of the technical specification process;
- make clear contractual agreements with the subcontractor: these written agreements need to specify deadlines, costs, quality expectations, equipment to be used, the location, environmental conditions (including temperature and humidity), security, insurance;
- choose the subcontractor on the basis of the digitisation work it has done in the past: - - contact some of its other clients and ask them about their experiences;
- take into account that public tendering procedures might be time-consuming;
- communicate clearly and precisely what needs to be digitised;
- communicate clearly how the files should be named and whether the subcontractor is

also expected to create derivative copies for access purposes;
- consider collaborating with other collecting institutions: a larger amount of works to be digitised can lower the digitisation cost per object;
- assure digitisation quality: ask for some tests in advance and foresee a quality control procedure;
- don not forget the metadata: think in advance about the procedure for putting metadata in a database or enhancing (e.g., adding the technical metadata in an existing database);
- make clear written arrangements for the transfer of copyright on the digital reproductions from the subcontractor (i.e., a reproduction photographer) to the collecting institution itself.

4. Defining the selection

4.1. DCA selection criteria

In the case of the DCA project, the selection of artworks to be digitised was made during the preparation phase. DCA's different collecting institutions have made their selections in accordance with the requirements of the project and their own needs.

The goal of the DCA project was to digitise contemporary art. Within the project, contemporary art is broadly defined as art created after 1945. The artworks to be digitised might have been selected because

- they carry an inherent cultural, historical, artistic or scientific value, visible to European citizens;[14]
- the collecting institutions consider them as most representative of their collections;[15]
- they have a special value for collective memory and evoke clear memories of persons, events or traditions that are important for the culture and history of Europe as a whole;[16]
- they indicate an essential phase in the oeuvre of an artist or an entire art movement;[17]
- the collecting institution has decided to digitise a whole body of works by one single artist including contextual documents that belonged to the archive of the artist him/herself;[18]
- they need to be digitised to preserve them and to make them accessible (again) for the audience;[19]
- the digitisation activities take place in synergy with other activities of the collecting institution.[20]

During the selection process the DCA content providers took into account the importance of masterpieces. The selected works have significant art historical value. Each collecting institution has acquired the artworks of its collection on the basis of the outstanding creativity, skill or workmanship demonstrated by the work. The artworks in their collection and the selection have often also been given much critical praise.

The DCA content partners have also selected some contextual documents for digitisation. These have been selected because contextual documents can contribute to a better understanding of contemporary art as a form of cultural heritage. For some artworks, this documentation may even be the only thing that can easily be preserved or made accessible (e.g., ephemeral time-based art forms such as performance).

4.2. General selection criteria

As part of the Flemish research project 'Preserving and disclosing multimedia data in Flanders' ('Bewaring en Ontsluiting van Multimediale data in Vlaanderen' or BOM-vl), researcher Bart Ooghe has listed five different aspects as selection criterion for works to be digitised.[21]

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[14] E.g., Moderna Galerija: influence of Neue Slowenische Kunst (NSK).
[15] E.g., Ars Electronica: overview of the Prix Ars Electronica winners.
[16] E.g., Moderna Galerija: linked to the disintegration of the Yugoslavian state.
[17] E.g., MMCA: sculptures of Achilleas Asperghis from '60-'70 from collection; FTAPIES: the artist books by Antoni Tàpies.
[18] E.g., HfG: works and documents by Stephan von Huene.
[19] E.g., argos and NIMk: video works in obsolete analogue formats.
[20] E.g., WRO: publication on media installations.
[21] BART OOGHE, *Selectie voor digitalisering in theorie en praktijk*, https://projects.ibbt.be/bom-vl/fileadmin/user_upload/frontendfiles/BOM-Vl%20WP2.2%20Rapport%20selectie.pdf

Although the BOM-vl project dealt mainly with audio-visual collections, we believe that such selection criteria are also valid for a digitisation project such as DCA, especially since a small but important part of the artworks and documents to be digitised in the project is audio-visual.

The five selection criteria that have an impact on the actual selection, are:

1. the institutional framework[22]
    - collection policy: the institution's collection policy will define the framework for the selection of the material. "A good digital collection is created according to an explicit collection development policy that has been agreed upon and documented before building the collection begins".[23]
    - purpose of digital collection: some collecting institutions have very specific goals in their collection policy for further developing their digital collection.
    - rights and administration: the copyright situation can be an obstacle to the digitisation of certain artworks and contextual documents or to making them accessible online.

2. the financial framework
    - digitisation costs: digitisation is expensive and the costs might determine the selection of artworks and contextual documents to be digitised.
    - cost of selection: the selection of artworks and contextual documents to be digitised might be a time-consuming and thus expensive process. Sometimes it might be easier to make the selection based on the type of artwork or document instead of on the content of the individual object. Sometimes it might even be less expensive to digitise all works or documents of a certain collection than to digitise just a selection.
    - cost of loss: if an important artwork or contextual document is subject to physical decay (e.g., artworks and documents on magnetic tapes) the collecting institution might ultimately risk losing it entirely. The cost of digitising the object and of preserving it digitally might be less than the cost of loss.
    - cost of metadata: metadata play an important role in digitisation projects. The planning and execution of the digitisation project might require a certain amount of metadata, and the selection might be influenced by the costs that are necessary to create or enrich such metadata.
    - potential income: a digital collection can generate financial income for the collecting institution. The income that certain artworks might be able to generate can influence the selection.

3. the physical condition or characteristics of the material
    - physical / technological accessibility: a lot of artworks and contextual documents are rarely exhibited; they spend most of their time in warehouses and archives. It is difficult for the general public, researchers and others to see these artworks on display or consult the documents. Some artworks even need to be assembled and installed first; others require special playback and display equipment.
    - condition of carrier: some artworks and contextual documents are vulnerable or subject to physical decay. It might be recommended to prioritise such artworks and contextual documents when making a selection.
    - quality after digitisation: if the achievable quality is insufficient, it might not be possible to include the artwork or contextual document in the selection.

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[22] Other aspects that could be added as part of the institutional framework, are:
    - location: artworks or contextual documents kept in appendices located at a very long distance from the museum's main premises or considered as long-term loans to other public institutions in other cities might be prioritised for digitisation, or on the contrary excluded from the selection;
    - time: digitisation schedules have to cope with the museum's long-term workflow. Some artworks or contextual documents might be prioritised for digitisation, or on the contrary excluded from the selection, because of programmed exhibitions or of a temporary closure due to extension and/or renovation work.
[23] NISO, *A Framework of Guidance for Building Good Digital Collections*, 2007, p. 5, http://www.niso.org/publications/rp/framework3.pdf

4. the value of the material

    - content value: the content of the artworks and contextual documents might be a determining factor in the selection, especially if the digitisation project aims to make artworks or contextual documents accessible as part of a certain theme, portraying a certain period or person…

    - usage value: this criterion is closely linked to that of content value but is more focused on the resulting usability or accessibility of the digitised artworks and contextual documents.

    - contextual value: each artwork and contextual document has a value itself but also exists within a certain context. It is created within a certain historical context, or by a certain artist, it may have played an important role in a specific event or evolution, etc. This context might determine the selection of the artworks and contextual documents to be digitised.

    - representativeness of the material: the selection can also be determined by the degree to which the artworks and contextual documents are representative, e.g. for a certain collection, a certain evolution…

    - selection based on relation: some artworks and contextual documents might be related to each other or to others that will or already are digitised. Such a relationship might determine the selection.

    - arbitrary selection: random sample: depending on the character of the collection the selection can also be determined by a random sample. In this case the artworks and contextual documents that are selected will correspond to a certain arbitrary criterion (e.g., a catalogue number ending with 6, created in the first year of every decade).

    - aesthetic considerations: some artworks can have a specific aesthetic quality. Based on this quality such masterpieces may be prioritised in the selection.

    - uniqueness of the material: the uniqueness of an artwork or contextual document will define its value and thus also determine whether it will be selected for digitisation or not. If the collecting institution has only a poor reproduction or access copy and has not digitised the original or master, it might be recommended to prioritise other artworks and contextual documents in the selection.

5. the available metadata: having digital reproductions without any metadata is somewhat useless. The lack of certain metadata on artworks and contextual documents might make it impossible to include them in the selection.

In the publication *Selecting research collections for digitization* Dan Hazen, Jeffrey Horrell and Jan Merrill-Oldham developed a decision-making matrix for selecting material for digitisation. It contains a cluster of questions with further elaboration of some of the issues involved.[24] According to Paul Ayris it can be summarised as:

    - Does the material have sufficient intrinsic value to ensure interest in digitisation?

    - Will digitisation significantly enhance access or increase use by an identifiable constituency?

    - What goals will be met by digitisation?

    - Does a product exist that meets identified needs?

    - Are rights and permissions for electronic distribution securable?

    - Does current technology yield images of sufficient quality to meet stated goals?

    - Does technology allow digital capture from a photo intermediate?

    - Are costs supportable? Does an institution have sufficient expertise in project management?

    - Is the local organisational and technical infrastructure adequate?

    - Can the project be re-defined to recast objectives? Can infrastructure needs be

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[24] DAN HAZEN, JEFFREY HORRELL, JAN MERRILL-OLDHAM, *Selecting research collections for digitization*, 1998, http://www.clir.org/pubs/reports/hazen/pub74.html

addressed?[25]

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[25] PAUL AYRIS, *Guidance for selecting materials for digitization*, http://eprints.ucl.ac.uk/492/1/paul_ayris3.pdf

5. Clearing copyright

5.1. ATHENA IPR Guide

Before starting digitisation activities the collecting institutions should examine whether the artworks (and contextual documents) to be digitised are still protected by copyright or not. This copyright could be an important obstacle in the digitisation of artworks (and contextual documents) and/or to make them accessible online. The fact that a collecting institution owns an artwork or contextual document does not mean that it also owns the copyright on it.

Copyright needs to be cleared with the creator, his/ her legal heirs (up to seventy years after the death of the creator) or the collective rights management organisation(s) that represent the creator or his/her legal heirs. As part of the ATHENA project DCA project leader PACKED has developed an online *IPR Guide* in collaboration with the Greek University of Patras. This *IPR Guide* can lead the content partner through a limited number of steps to clear copyright.[26]

The following seven steps will help clear copyright:[27]

1. identify the work and the creator:
   - what is the title?
   - who is the creator?

2. examine whether the work is protected by copyright:
   - is the work an original work?[28]
   - is the creator still alive?
   - if the creator is no longer alive, how long ago did he/she die?
   - is there more than one creator?
   - how many other creators are there?
   - are the other creators still alive?
   - if the other creators are no longer alive, how long ago did they die?
   - has the creator used works by others in his/her piece?
   - if the creator has used works by others, has he/she guaranteed that the rights on such works have been cleared for the said use ?
   - can the creator invoke the exception of 'parody' for the use of other works for which the rights have not been cleared?
   - who is the creator of the works that have been used?

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[26] The IPR Guide can be found at http://devel.silktech.gr/athenaeurope_ipr/lang_en/page/home-page

[27] The seven steps are mainly dealing with the economic aspect of copyright. Beside an economic aspect copyright also has a moral aspect. The moral aspect defines that the creator can decide whether and how his/her name will be mentioned on the work (= the author's right of paternity). The creator also has the right to decide to use a pseudonym instead of his/her real name. Only the creator can decide whether and when his/her work will be made public (= the author's right of divulgation). The creator also holds a right of integrity. Preserving the integrity of the work bars the work from alteration, distortion, or mutilation that can damage the honour or reputation of the creator. The moral aspect can for instance come into play through the use of hyperlinks when making the work accessible online:
   - a deep link can create an infringement of the author's right of paternity because it is possible that the name of the creator is not mentioned on the page that the user visits;
   - an inline link can create an infringement of the author's right of integrity because the work might be integrated in a context that damages the honour or reputation of the creator;
   - framing might create an infringement of the author's right of integrity because only a part of the work is shown and can also create an infringement of the author's right of paternity because the name of the author falls outside the frame.
The collecting institution should also take into account this moral aspect of copyright.

[28] A work is only protected by copyright if it is original. The threshold to accept originality is fairly low and most artworks and written works will be considered original. Certain texts, images or works will be considered to be without originality because there was no personal choice of the author in its creation (examples: weather report, administrative form, very simple drawing).

- is this creator of the works that have been used still alive?
- if the creator of the works that have been used is no longer alive, how long ago did he/she die?
- is there more than one creator of the works that have been used?
- how many other creators of the works that have been used are there?
- are the other creators of the works that have been used still alive?
- if the other creators of the works that have been used are no longer alive, how long ago did they die?

3. for the use of photographic images (reproductions) of a work:
    - do you have the creator's permission?
    - is the creator still alive?
    - if the creator is no longer alive, how long ago did he/she die?

4. special problems:
    - does the work portray a person?
    - is permission required of the portrayed person?[29]
    - are there any privacy issues?[30]

5. license in place and license needed:
    - if the work is protected by copyright, does your institution have a license at present?
    - if so, what does this license cover?
    - what do you want the license to cover?
        ° digitisation?
        ° access by authorised user through secure networks?
        ° online accessibility over open networks?

6. obtaining the license ?
    - who represents the creator for the license in view?
    - does the creator represent him/herself?
    - does the creator assure that he/she has not handed over the rights to a collective rights management organisation?[31]
    - if the creator is no longer alive, who represents the legal heirs for the license in view?
    - does a collective rights management organisation represent the legal heirs?

7. specific works (neighbouring rights)
    - is the work a musical piece or does it contain music?
        ° do you have a license from the music publisher?
        ° do you have a license from the music producer?
        ° do you have a license from the musicians?
    - is the work an audio-visual work or does it contain an audio-visual work?[32]
        ° do you have a license from the film producer?[33]

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[29] Whereas the portrait of a private person cannot be portrayed without his/her permission, the portrait of a public person (e.g., politician or artist) can be produced without such permission, although not for commercial use.
[30] Matters related to the private life of an individual cannot be made public without authorisation.
[31] Creators can be members of collective rights management organisations that collect royalties from users and represent the authors.
[32] If the audio-visual work that is held by the collecting institution is a recording of a television or radio broadcast, the collecting institution also needs permission from the broadcast station.
[33] Everyone who has made an important (creative) contribution to the creation of a film can claim or transfer rights. Usually the economic rights are transferred to the film producer. This transfer is necessary to make it possible for the producer to exploit the work and to earn back his/her financial investment. In return he /she owes an adequate compensation to all creative contributors. Often this adequate compensation is arranged by the payment of a *lump sum*. For this reason the screening of a film requires the permission of the producer, not of the film director. The producer decides whether he/she gives the permission for the screening, whether he/she wants a screening fee and how often and/or how long the film can be screened.

° do you have a license from the actors?

5.2. Video.kunstrechten.nl

For video art collections the Dutch DCA partner NIMk[34] developed, in collaboration with Kennisland and the Foundation for the Conservation of Contemporary Art (SBMK, an online tool to clear copyrights for online display in 2012. This tool can be found at http://video.kunstrechten.nl/. Unfortunately, it is only available in Dutch and based on the copyright regulations in the Netherlands. One can start using the tool by selecting one of the four entries, depending of the goal of the copyright clearance:
- internal use;
- online display on own website;
- online display on external website;
- online display of own work.

The tool does not offer solutions for all situations, but the main principles and considerations are:
- individual video artwork versus complete collection;
- copyright on the video artwork versus copyright on the artworks shown in the video artwork, with reference to the role of a collective rights management organisation;
- limited access with the help of digital rights management technology versus open access;
- low quality versus high quality for online access.

5.3. Orphan works

A common problem with copyright clearance is the problem of *orphan works*.[35] An *orphan work* is one that is presumably still protected by copyright, but whose rights holder(s) are not known or cannot be traced. This implies that the collecting institution that wants to use the *orphan work* in a way that requires the permission of the rights holder(s) (for instance for digitisation or online access), cannot obtain this permission. Ultimately, this might result in the loss of the work due to the fact that often the collecting institution requires legal certainty to preserve the work and make it accessible. A solution for the problems of *orphan works* is currently sought after on a European political level. This solution can head in two directions: towards a solution based on extended collective licensing or a solution based on a new exception in the copyright law.

The system of extended collective licensing is based on the collective management of rights and legally provides for the coverage of (the interests of) 'missing authors'. An extended collective licence (ECL) covers the use of works of rights holders who are not represented by a collective rights management organisation. This provides users with the security to legally copy materials without the threat of individual claims from rights holders who are not members of the Collective Rights Management Organisation (CRMO) that granted them a license. In cases in which a CRMO is deemed to represent a 'critical mass' of rights holders in a certain domain, it is assumed to act for all rights holders in that domain. The works of all rights holders in this field (whether domestic or foreign) are assumed to be part of the repertoire of the CRMO unless the rights holder specifically opted out of this ECL system (by explicitly stating that he or she does not want to be represented under an extended collective license). Rights holders who choose to leave the system will not be covered by the extended collective license any longer. However extended collective licensing can also be beneficiary for rights holders: it

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[34] NIMk ceased to exist at the end of 2012 due to budget cuts. Some former staff members of NIMk started LIMA on 1 January 2013 and took over NIMk's role in DCA.
[35] Within the DCA project this risk of *orphan works* is small since all artworks are created after 1945.

guarantees remuneration for rights holders since their works are assumed to be in the repertoire of the relevant collecting society. Extended collective licensing can reduce the cost of obtaining a licence; instead of investing time and money on several individual licences, a requester may, under an ECL, obtain one licence for a broad repertoire of works. Extended collective licensing has the potential to be a mechanism for the quick and efficient processing of agreements. Unfortunately this system can also be costly; one risks having to pay for the use of works for which the rights holders would never show up or request the payment of a license fee.

The alternative solution is based on a new exception in the copyright law. The advantage of this solution is that no license fee needs to be paid unless the rights holders show up and request a payment. The disadvantage is that a *diligent search* needs to be carried out. A *diligent search* is one that is performed according to predefined criteria. Common criteria are:
- the search must be performed before the use of the work;
- the search must be performed title by title or work by work;
- a number of relevant sources must be consulted during the search;
- a communication must be published in which the rights holders are asked to make their identity known;
- the search must be documented;
- if the work gets used, this use must happen with a declaration that the work is still protected by copyright but that the rights holder(s) could not be traced.

Performing a *diligent search* is time and labour consuming. But at the same time this solution offers room for risk management. One can decide to perform only a *diligent search* on artworks for which one assumes that there is still a rights holder and that this rights holder might want to claim a license fee.

Since September 2012 there is a directive of the European Parliament and of the Council on certain permitted uses of orphan works.[36] The next step is the implementation of this directive into the different national jurisdictions. Only after such implementation will the directive become legally binding. The expectation is that the implementation in the different national jurisdictions will take place in 2014 or 2015.

5.4. Some recommendations for collecting institutions

It is recommended to try to clear the copyright directly with the artists.[37] In many cases the artists of the selected artworks will still be alive, and often collecting institutions have a direct relationship with them. This might make it possible to clear copyright without the interference of collective rights management organisations. It also makes it possible to explain the purpose of the digitisation project directly to the artists, as well as the benefits of online display for them in terms of promotion and reaching a broader audience for their work. Many artists consider such online display as having a promotional value for their work and career. In many cases the preservation of their works will also benefit from digitisation, while the artists might not have the means themselves to take care of such digital preservation or digitisation at all.

Collecting institutions should also consider creating a standard copyright agreement they can submit to the artist, or other right holders, when acquiring an artwork (or contextual document).

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[36] For more info, see http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P7-TA-2012-0349+0+DOC+XML+V0//EN
[37] Clearing copyright directly with the artists can be done by sending all applicable artists a 'friendly letter' that briefly explains the situation and proposes license. To avoid having to repeat this procedure in the future, we advise collecting institutions to try clearing the copyrights for the broadest possible scope at once.

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6. Analysing the artworks and contextual documents to be digitised

6.1. Analysing artworks and contextual documents in general

The next stage in the digitisation process is the analysis of the artworks (and contextual documents) that need to be digitised. During this stage the collecting institution needs to determine what the specificities are of the material that will be digitised. The analysis concerns:

- the intrinsic properties of the material to be digitised, e.g., the colours or richness of detail, since such properties need to be respected[39] during the digitisation process;
- the place where the artwork (or contextual document) is being stored or exhibited, e.g., a depot in another part of the city or an additional exhibition space on an island far away from the museum on the mainland, since this will have a direct effect on the time and effort needed to do the digitisation.

A complete and up-to-date catalogue or inventory (preferably as part of an electronic collection management system) is an important tool. It provides a lot of useful information for the analysis of the artworks to be digitised.

6.2. Analysing the works of fine art and contextual documents

For works belonging to the category of fine art (painting, sculpture, photography, works on paper, installation) and for contextual documents, the issues that most frequently need to be addressed are:

- is the artwork (or contextual document) in good condition? Does it need cleaning or restoration prior to digitisation?
- is the work two- or three-dimensional?
- are several digital reproductions needed of the same artwork (or contextual document)?[40]
- how many works are there within the object (an artist book might contain multiple drawings or etchings – should it be considered one or several works)? Are all the parts related to the same artist?
- is the front and back of the object to be digitised or just one side?[41]
- is special lighting or special imaging such as infra-red going to be required?
- if the artwork (or contextual document) is a work on paper: how fragile is it? Is it rolled, or mounted on cardboard? Can it be exposed to the same type and amount of light as other objects?
- given the dimensions of the artwork, should it be digitised on site or can it be moved to another place (such as a photo studio)?
- does one need a restorer to remove the frame or dismount the work? If so, does this fit in the planning?
- how to install the artwork? Does one need special technical assistance to install it if it is not on display during the digitisation period?

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[39] Or maybe even improved through digital restoration for access purposes (derivative copies).
[40] The digitisation of a three-dimensional artwork might lead to more than one digital reproduction (made from different angles of view).
[41] For paintings it is worth considering the digitisation of both front and back. Also some drawings are made recto-verso.

6.3. Analysing the audio-visual works and contextual documents

For the works belonging to the category of audio-visual works, the issues that most frequently need to be addressed are:
- what is the physical carrier, what is the physical format?
- what is the age of the work and/or carrier?
- what is the physical condition of the carrier?
has the content been sliced together and what is the condition of the splice points?
- what is the storage history of the work and/or carrier? According to which specifications were the works-to-be-digitised stored?
- what is the content on the carrier? What is the genre of content on the carrier? What is the status of the work and/or carrier?
- how many works are there within the object (a videotape might contain multiple works – should it be considered to be one or several works)?
- does all the content run in one direction on the tape or film?[42]
- do other (better) copies of this work exist?

In some cases it will become clear during the analysis of the material whether it is necessary to clean and/or restore the carrier prior to digitisation. The cleaning and/or restoration of the carrier might be necessary to assure smooth playback. If there is no smooth and correct playback of the audio-visual work, it will be impossible to digitise it properly.

Different types of carriers exist for audio-visual works:
- audio:
    ° electro-mechanical audio carriers;
    ° magnetic audio carriers;
    ° optical carriers;
    ° magneto-optical carriers;
- video
    ° magnetic video carriers;
    ° optical carriers;
    °magneto-optical carriers;

Prior to digitisation it is necessary to know the exact type of carrier on which the work is stored. This is necessary to be able to prepare the material correctly, and to determine which playback equipment is required to perform the digitisation. Usually the information about the carrier will not be sufficient: the carrier types will often have different format types and these require their own specific playback equipment. Some format types are used by different brands, and the playback equipment might also be available in alternative brands. Other format types are only used by one brand, and the playback equipment might also only be available from this one brand.

The following websites are helpful for determining audio formats:
- *Sound carriers* (Swiss national Sound Archives), see:
http://www.fonoteca.ch/yellow/soundCarriers_en.htm
- *Memoriav – Préserver le patrimoine audiovisuel / Memoriav – Audiovisuelle Kulturguterhalten*, see:
http://en.memoriav.ch/dokument/Empfehlungen/recommandations_son_fr.pdf
http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_video_de.pdf

The following websites or webpages are helpful for identifying video formats:

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[42] Sometimes content can been found when the content is joined at the middle and is made up of two works with each work running from a separate end of the tape/film in to the middle.

    - Videotape Identification and Assessment Guide (Texas Commission on the Arts),
    see: http://www.arts.state.tx.us/video/
    - The Little Reference Guide for Small Video Collections (Barry Van der Sluis - The
    Little Archives of the World), see: http://www.little-archives.net/guide/
    - Video Format Identification Guide (Sarah Stauderman & Paul Messier - Video
    Preservation Website), see: http://videopreservation.stanford.edu/vid_id/index.htm
    - Memoriav – Préserver le patrimoine audiovisuel / Memoriav – Audiovisuelle
    Kulturguterhalten, see:
    http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_video_fr.pdf or
    http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_video_de.pdf

The following website or webpages are helpful for identifying film formats:
    - Film Identification, Film Preservation Handbook (National Film and Sound Archive),
    see: http://www.nfsa.gov.au/preservation/film_handbook/film_identification.html
    - Film Gauge Identification, Moving Image Collections: Guidance Notes (Film Archive
    Forum), see: http://bufvc.ac.uk/faf/guidancenotes.pdf

To check the quality of audio-visual works one should follow the five following steps:
1. check the packaging before opening it:
2. once the packaging is opened, check the smell; [43]
3. check the cassette, the reel, the surfaces and the edges of the tape; [44]
4. identify the material and the format;
5. check the content / signal on the tape.

The most common problems with magnetic tapes are:
- *sticky shed syndrome*;[45]
- *vinegar syndrome*;[46]
- print through effect;
- poor playback signal; [47]
- demagnetising;
- edge damage or warped tape;[48]
- mould;[49]
- powder forming and crystallisation.[50]

The result of the inspection should be recorded in a condition report. The creation of this kind of report is part of the general conservation task of a collecting institution. The information in the condition report can be valuable for digitisation preparation and also for the subcontractor (e.g., a film or video lab).

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[43] For instance a vinegar-like odour might be the result of the vinegar syndrome.

[44] Look especially for edge damage or warped tape, mould, powder forming and crystallisation, bad splices and torn perforations (film).

[45] The phenomenon whereby a tape binder has deteriorated to such a degree that it lacks sufficient cohesive strength to prevent the magnetic coating from shedding during playback. Causes dropouts on videotapes and will clog video and/or audio heads. In case of the sticky shed syndrome it is recommended to contact a professional lab that knows how to deal with this as soon as possible. The affected tapes will have to be digitised. Before digitisation they will have to be thoroughly cleaned or even baked or dried by the digitisation lab.

[46] Characteristic of the decomposition of acetate-based film or very early magnetic tape where acetic acid is a substantial by-product that gives the film or tape a vinegar-like odour. After the onset of the vinegar syndrome, acetate film or tape backings degrade at an accelerated rate. The hydrolysis of the acetate is catalysed further by the presence of acetic acid by-product. In case of the vinegar syndrome it is recommended immediately isolating the affected films or tapes from the ones that are not affected and to contact a professional lab that knows how to deal with this as soon as possible. The affected films (or very early magnetic tapes) will have to be digitised (or copied on new film stock).

[47] A poor playback signal can often be improved by adjusting the tracking and by using a Time Base Corrector (TBC).

[48] It is recommended to contact a professional lab that knows how to deal with this. Edge damage or warped tape may result in (further) damage of the tapes and the playback equipment.

[49] It is recommended to contact a professional lab that knows how to deal with this as soon as possible. Mould causes some health risks.

[50] It is recommended to contact a professional lab that knows how to deal with this as soon as possible.

7. Preparing the artworks to be digitised

7.1. Preparing artworks in general

In order to assure a smooth digitisation procedure it is necessary to prepare the artworks.

It might be recommended to group the artworks according to for instance their type, carrier type, carrier format, size and/or location. It might be interesting for example:
- to move all smaller artworks to the room where the larger artworks need to be digitised - the smaller artworks can probably be easily moved or transported while the larger artworks need to photographed on site;
- to bring all audio-visual works in a certain carrier format together (e.g., digital Betacam videotapes) – the larger the number of works in a certain carrier format to be digitised together, probably the smaller the digitisation cost per carrier.

We will not treat the preparation of the artworks to be digitised in depth in this deliverable *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks* because the preparation can usually be considered as part of the conservation of the artworks in general.

It is important to stress the importance of labelling the artworks or contextual documents, especially if they have to leave the premises of the collecting institution for digitisation. If the artworks or contextual documents are not yet properly labelled, it is - when possible - recommended to do this prior to digitisation. Labelling prevents artworks or contextual documents getting lost or the wrong artworks or contextual documents being digitised. One can label both the artworks or contextual document and the packaging. Some useful information for recording the labels might be to include:
- the unique identifier used in the inventory or collection management system;
- the title of the artwork or contextual document;
- the name of the collecting institution that owns or takes care of the artwork or contextual document;

It might also be necessary to clean the artwork (or even contextual document) prior to digitisation. Cleaning should be considered part of the common conservation practice of collecting institutions.

It might also be necessary to restore the artwork (or even contextual document) before digitisation. When referring to restoration we mainly mean the restoration of the material.

In some cases (for instance paintings and sculptures) it might be worth considering digitising the work before and after restoration. This might be important in order to document the restoration process in a scientific way. Sometimes an artwork is cleaned or restored just before it goes on display in an exhibition. It might also be worth taking this into account when planning digitisation.

Preparing large installations for digitisation can also be difficult. Installations can contain many components, some of which can be audio-visual. If there is a lack of space, one should consider digitising installations in a specific timeframe. Components can be stored at different locations, and installing the artwork can be complex and time-consuming.

7.2. Preparing audio-visual artworks

An important difficulty in the preparation of audio-visual artworks is that one needs very specific equipment - not only playback equipment to view the works but also equipment to clean the carriers and restore the signal that is stored on the carriers.[51]

It might be necessary to clean not only the carrier on which the work is stored but also the playback equipment that is required to digitise the work. If you notice some dirt on the carrier (e.g., a magnetic videotape) or container during the inspection, special cleaning is required prior to digitisation. It is also possible that cleaning is required during the digitisation process itself, for instance when the playback heads clog and the playback equipment eventually stops due to dirt on the videotape. Before restarting, both the equipment and the tape need to be cleaned. The possible consequences of dirt might be:
- damage to both the carrier and the equipment;
- a poor playback signal (for instance drop-outs) and therefore a poor digitisation result.
Cleaning carriers (especially magnetic tapes) is often a precise and difficult process that needs to be carried out by a skilled person with special equipment. Incorrect cleaning might result in permanent damage to the carrier. The playback equipment also needs to be cleaned regularly. The use of dirty and badly aligned playback equipment will not only result in a poor playback signal and digitisation result, but can also damage the carrier permanently.

Restoration of the carrier might also be necessary for audio-visual works stored on magnetic tapes. In this case the material restoration is focused on the restoration of the carrier itself. The goal is to try to stabilise damaged or deteriorated tapes. A faulty tape will be treated to enable playback with the original quality. A well-known example is the *baking*[52] or *drying* of tapes that suffer from the *sticky shed syndrome*.

Another form of restoration for audio-visual works does not concern the carrier itself but the actual signal that is stored on the carrier. The goal of this type of restoration is to get as close as possible to the original signal quality. Video signal restoration can be done by using a *Time Base Corrector* (TBC). The TBC is a piece of equipment that is put between the playback equipment and the digitisation device. This means that this kind of signal restoration in fact happens during the digitisation itself. The reason one might use a TBC is that most old video signals are not stable enough to be captured well enough by modern video equipment. In professional video labs different TBC devices are often combined. With the TBC one can also correct the video level, the black level, the chrominance and the colour phase.[53] Colour corrections can also be done using a colour corrector. When making colour corrections it is important to be aware of the danger of subjective decisions. The goal should always be to enable a playback with the original quality, not to make the quality better than it originally was.[54] If a colour bar is present on the tape, adjust the colours of the colour bar with the use of waveform vectorscope. If no colour bar is present on the tape, use a test tape with a colour bar to adjust the equipment prior to digitisation.

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[51] The playback of digital carriers (e.g., CD-Rom) does not only require specific hardware but also specific software (e.g., a specific version of an operating system).

[52] A process in which a magnetic tape is placed at an elevated temperature for a brief time in order to firm up the tape binder. This procedure can be carried out as a temporary cure for sticky shed or sticky tape syndrome.

[53] Be aware of delay in video signal caused by the use of a TBC. TBC corrects the video signal and passes it on again one frame ahead (1/25 of a second) at a stable frame rate. This means that the audio should be delayed by the same amount. The use of an audio delay unit can make sure that the audio and video signals get synchronised again after the processing of the video signal.

[54] This also relates to the digitisation of, for instance, slides. Their colours might have faded in time and need some correction.

8. Defining quality parameters

8.1. Defining quality parameters in general

Before the actual conversion from analogue to digital begins, one needs to define the quality parameters for the digital result that one aims to achieve. These quality criteria will be determined by
- the digitisation goals;
- the physical characteristics of the analogue original;
- the means available.

When defining quality parameters, the following aspects need to be taken into account:
- content requirements: when digitising a collection, the content itself needs to be taken into account – it is not only important to define what is relevant to digitise within the collection, but also to define which aspects of an item need to be maintained in the digital file;
- usability: when digitising a collection for access purposes, the quality of the resulting digital files needs to meet the quality required;
- readability: when digitising a collection one should make sure it's possible to read the resulting digital files, to represent and interpret them;
- essence versus structure versus detail: as caretaker of a collection you should evaluate:
  ° the essence: the actual content of the artwork or contextual document – is it possible to understand the work?
  ° the structure: the structure of the artwork or contextual document – what is the composition and consistency of the artwork or contextual document?
  ° the detail: to be determined by the caretaker of the collection – what is the smallest meaningful detail of the artwork or contextual document?

During the actual conversion from analogue to digital an analogue artwork or contextual document is converted into a digital reproduction. This conversion from analogue to digital takes place over three stages:
1. the sampling;
2. the quantification;
3. the coding.

When making a digital image through reproduction photography or scanning, the light rays reflected by an artwork or contextual document are transferred into a voltage. Something similar happens when one records sound waves digitally. If one starts with a video or audio recording on a magnetic tape the voltage is a result of the information stored on the carrier. This voltage will be sampled, i.e., a device will measure, at regular intervals or frequency, the power or amplitude of the voltage. Subsequently the device will convert this amplitude of each analogue sample value into a binary number during the quantification. An infinite amount of information therefore gets translated into a limited number of values. In the last stage, the coding, the long chain of 1's and 0's, is adapted, divided and structured without affecting the information itself. These coded digital data can be processed, stored, and transported.

8.2. File types

The end result of the digitisation process can be stored in three different types of files:
- an archival master file (or files);
- a production master file (or files);
- a derivative file (or files).

Each type of file will have its own quality parameters.

On the content level we also make a distinction between three different file types:
- image files (containing a still image);
- moving image files (containing video with or without audio);
- audio files (only containing audio).
We believe that we can convert all artworks and contextual documents selected for digitisation within the framework of the DCA project to at least one of these three file types.

8.1.1. Archival master file

We found the definition of the Federal Agencies Digitization Guidelines Initiative (FADGI)[55] very helpful. They describe the archival master file as follows:

"File that represents the best copy produced by a digitizing organization, with *best* defined as meeting the objectives of a particular project or program. These objectives differ from one content category to another […]. In some cases, an archive may produce more than one archival master file.

The terms used to name types of files vary within the digital library and digital archiving communities. In many cases, the best copies are called *preservation master files* rather than *archival master files*. In some cases, best-copy files are defined in qualitative terms, as part of an approach that requires all archival or preservation master files to meet the same specifications, without regard to objectives that vary by category.

Archival master files represent digital content that the organization intends to maintain for the long term without loss of essential features. For analogue originals, archival master files are produced by reformatting to high standards. Practices vary from archive to archive regarding adjusting or cleaning up the content in the file. (This refers to adjustments like changing image tonality or reducing the audibility of clicks and pops in sound recordings.) Some archives may make such adjustments in real time when digitizing, but most apply such changes later in the workflow when production master files are created.

The digital formats for archival master files are selected in terms of sustainability factors. For born digital originals, if the existing format is deemed sustainable for the long term, the files are retained as-is and called *archival masters*. If the existing format is deemed unsuitable for long-term retention, e.g., it is an obsolescent format, then the content may be transcoded and the new version retained as the archival master. (If there is risk of data loss from the transcoding, files in the existing format may also be retained for possible future reference.)

Archival master files are the starting point when organizations produce the production master files and/or derivative files that will in turn support a wide range of objectives, e.g., the provision of end-user access; high quality reproduction; and the production of textual representations from OCR, voice recognition, or other similar process. It is again the case that practices vary, with some archives or projects seeing the creation of additional file types with nuanced differences in their characteristics. For example, […] when the Indiana University team digitized analog sound recordings, they produced *preservation master files*, *preservation master-intermediate files*, and *production master files*, as well as *derivative files* […].Some projects will produce *preservation master files*, *production/AV intermediate files*, and *reference*

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[55] Started in 2007, FADGI is a collaborative effort by American federal agencies to define common guidelines, methods, and practices for digitising historical content. As part of this, two working groups are studying issues specific to two major areas, Still Image and Audio Visual. The Still Image Working Group is involved in a cooperative effort to develop common digitisation guidelines for still image materials. The goal for the Audio-visual Working Group is to identify, establish, and disseminate information about standards and practices for the digital reformatting of audio-visual materials.

files, in addition to *derivative files*.

Master files of all types have permanent value and should be managed in an appropriate environment, e.g., one in which read and write executions are minimized and other preservation-oriented data management actions are applied. In contrast, derivative files are frequently accessed by end-users and are typically stored in systems that see repeated read and write executions."[56]

8.1.2. Production master file(s)

We found the definition of the Federal Agencies Digitization Guidelines Initiative (FADGI) very helpful. They describe the production master files as follows:

"Files produced by processing the content in one or more archival master files, resulting in a new file or files with levels of quality that rival those of the archival master.

The first type of processing consists of the assembly of a set of segments into a unified reproduction of an item. For example, an image of a large map may be produced by stitching together a set of image tiles, each representing a portion of the original paper item. In the realm of sound recordings, a number of segments may be assembled to represent a long work, or a number of separate tracks may be mixed into a single, stereo presentation. If both the segmented and the assembled representations are retained by the digitizing organization, the originally captured segments are called *archival master files* and the assembled version is called a *production master file*.

The second process that may be applied consists of aesthetic or other technical corrections to the original file. When both the uncorrected and corrected representations are retained, the uncorrected files are *archival master files* and the corrected versions are *production master files*. For most preservation-oriented archives, aesthetic changes will be modest. For images, aesthetic changes may include such things as adjusting tonality; for sound recordings, such adjustments may reduce the audibility of clicks and pops, or correct drastic changes in level. Certain technical changes may be more significant. For example, the *archival master* version of a pictorial image may employ a linear representation of light intensity (see the explanation in gamma), while the production master may employ gamma correction. The transformation from linear to gamma-corrected is not reversible in a mathematically exact manner.

This glossary provides definitions for the two master-file archetypes named above. It is the case, however, that some archives or projects produce additional file types with varying names and nuanced differences in their characteristics. For example, […] when the Indiana University team digitized analogue sound recordings, they produced *preservation master files* (the equivalent of an archival master file), *preservation master-intermediate files*, and *production master files*, as well as derivative files […] Some projects will produce *preservation master files* (the equivalent of an archival master file), *production/AV intermediate files*, and *reference files*, in addition to *derivative files*.

Master files of all types have permanent value for the digitizing organization and should be managed in an appropriate environment, e.g., one in which read and write executions are minimized and other preservation-oriented data management actions are applied. In contrast, derivative files are frequently accessed by end-users and are typically stored in systems that see repeated read and write executions."[57]

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[56] See http://www.digitizationguidelines.gov/term.php?term=archivalmasterfile
[57] See http://www.digitizationguidelines.gov/term.php?term=productionmasterfile

8.1.3. Derivative file(s)

We found the definition of the Federal Agencies Digitization Guidelines Initiative (FADGI) very helpful. They describe the derivative files as follows:

 "Often called *service*, *access*, *delivery*, *viewing*, or *output* files, derivative files are by their nature secondary items, generally not considered to be permanent parts of an archival collection. To produce derivative files, organizations use the archival master file or the production master file as a data source and produce one or more derivatives, each optimized for a particular use. Typical uses (each of which may require a different optimization) include the provision of end-user access; high quality reproduction; or the creation of textual representations via OCR or voice recognition. In many cases, the derivatives intended to serve end-user access employ lossy compression, e.g., JPEG-formatted images, MP3-formatted sound recordings, […]. The formats selected for derivative files may become obsolete in a relatively short time."[58]

8.2. Quality parameters for image files

8.2.1. General quality parameters for image files

8.2.1.1. Resolution

During the digital photography process the image is converted to a raster image, also called a bitmap. A raster image represents an image in a series of bits of information that translate into pixels on the computer screen. Each pixel is assigned a specific value that determines its colour. Together they create an overall finished image.

The resolution refers to the amount of pixels. The resolution is expressed as the combination of the number of horizontal pixels and the number of vertical pixels, e.g., 8.956 x 6.708 pixels. This yields in what is expressed as the number of megapixels, e.g., 60.1 megapixels in the case of a resolution of 8.956 x 6.708 pixels.

Every camera has a fixed maximum optical resolution that is linked to the size of its sensor. One should make sure that the resolution of one's camera matches one's quality requirements. The camera will often be listed with information about its maximum optical resolution and an interpolated or software resolution. The optical resolution is the figure to look for – interpolated resolution uses software to 'guess' the value of pixels between those that the camera can optically register. Interpolation should be avoided.

The digital archival master file should be created with the highest suitable resolution that is both affordable and practical. The amount of resolution required for a useful image of an artwork is determined by the size of the original, the amount of detail in the original and the envisaged use(s) of the digital reproduction (e.g., the desired size of the image and the resolution of the printer or monitor). Raising the resolution will at a certain point no longer add extra information to the digital data. One also has to keep in mind that a higher resolution results in a bigger file size, a slower processing speed and a larger (and thus more costly) storage capacity.

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[58] See http://www.digitizationguidelines.gov/term.php?term=derivativefile

8.2.1.2. Bit depth

Bit depth, also called colour depth, is the number of 0's and 1's or bits[59] that are used to represent the colour of a single pixel in a bitmapped image. Higher values for colour depth indicate a broader range of distinct colours. One should decide how many bits are required to match the colour information that is intrinsic to the analogue original. Images with higher bit depths can encode more shades or colours since there are more combinations of 0's and 1's available.

Each colour pixel in a digital image is created through a combination of the three primary colours: red, green, and blue. Each primary colour is often referred to as a *colour channel* and can have any range of intensity values specified by its bit depth. This is why bit depth for each primary colour is referred to as *bits per channel*. The *bits per pixel* (bpp) refers to the sum of bits in the three colour channels and represents the total colours available at each pixel.

A 1-bit image is a black and white image without any grey values in between; the pixel has only 1 bit and is therefore black or white. An 8-bit image has 256 shades of either grey or colour (2^8 = 256 shades) and a 16-bit image has an average of 65.000 shades of either grey or colour. The average colour scan or colour photograph is a 24-bit image (8 bits per channel).[60] A high-quality digital photo camera or scanner produces a 48-bit image (16 bits per channel). 16 bits per channel is recommended when making extensive adjustments to the image. For use the 16 bits will have to be reduced to 8 bits per channel for nearly all forms of output, but it remains recommended to keep the high-quality archival master file in 16 bits per channel – although opening the files might in some cases require special viewing software.

8.2.1.3. Colour space

The photographic image that the camera or scanner creates consists of the blending (in variable amounts) of the primary colours: red, green and blue. We distinguish between two main types of colour blending: additive colour blending and subtractive colour blending.

RGB is an additive system of colour blending. This is a system that creates colours by blending other colours. White light is created when the three light sources converge with the primary colours red (R), green (G) and blue (B). One starts without light (black) and adds light with certain colours. The opposite of additive colour blending is called subtractive colour blending. CMYK is a subtractive system of colour blending. One starts with white light and creates colour by subtracting the primary colours. While the additive system RGB is used for display on screens, the subtractive system CMYK is used for professional offset printing.
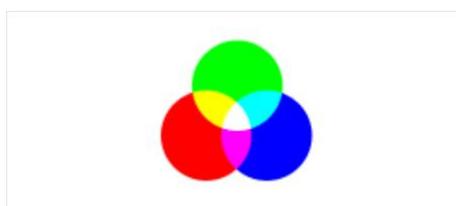
Red, Green, Blue – Additive colors   Cyan, Magenta, Yellow – Subtractive colors
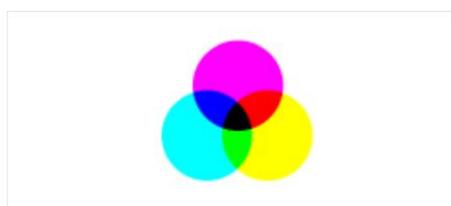
Colour models such as RGB or CMYK are abstract mathematical models that describe the way colours can be represented as tuples of numbers, typically as three or four values or colour

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[59] A bit (a contraction of binary digit) is the basic unit of information in computing and telecommunications; it is the amount of information stored by a digital device or other physical system that exists in one of two possible distinct states.
[60] The offset printing industry also works with a bit depth of 8-bit per channel.

components. However, a colour model with no associated mapping function to an absolute colour space is a more or less arbitrary colour system with no connection to any globally understood system of colour interpretation. Adding a specific mapping function between the colour model and a reference colour space results in a definite footprint within the reference colour space. This footprint is known as a gamut, and, in combination with the colour model, defines a new colour space. For example, Adobe RGB, eciRGB, ProPhoto RGB, AppleRGB and sRGB are different absolute colour spaces, all based on the RGB model.

Please note that the colour range of the AdobeRGB, eciRGB[61] and ProPhoto colour space is broader than the colour range of the CMYK colour spaces and than the AppleRGB and sRGB colour spaces. sRGB is the default setting on most cameras. This means that one might have to change this setting when shooting high-quality digital reproductions.

AdobeRGB and sRGB both use a 2.2 gamma with a D65 white point (6.500 K°). ProPhoto uses a 1.8 gamma with a D50 white point (5000°). eciRGB also has a D50 white point but uses a different L* gamma. The recommendations of ANSI and ISO recommend a D50 lighting throughout the graphic chain.

8.2.1.4. File format

A good digital photo camera for reproduction purposes creates RAW files that contain the original information read by the image sensor. There are as many RAW formats as there are camera types and brands; Hasselblad has its own, Nikon too, etc. Unlike the JPEG and TIFF file formats that store images that have been processed by the camera, RAW files capture unprocessed or minimally processed data directly from the camera sensor. Because they are in some ways similar to film negatives in a photographer's workflow, camera RAW formats are often referred to as 'digital negatives'.

Camera RAW formats offer both advantages and disadvantages. An advantage is the increased control for the end user. The user can precisely adjust a range of parameters, including white balance, tone mapping, noise reduction, sharpening and others, to achieve a desired look. A disadvantage is that unlike the JPEG and TIFF files that are ready for immediate use, camera RAW files must be processed before they can be used. This processing typically happens with the help of software provided by the camera manufacturer or by using a converter.

While it is recommended to shoot in a RAW format instead of JPEG or TIFF, it is also recommended to use the Uncompressed Baseline IBM[62] TIFF v6.0 file format instead of a RAW

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[61] The main disadvantage of eciRGB as compared to AdobeRGB is that it is less widely supported.

[62] 'IBM' stands here for a little-endian byte order. A big-endian byte order is sometimes indicated as 'Mac'. If you use, for instance, Photoshop to make a scan, a window will open at the moment you want to save the file and you will be asked to indicate whether you prefer an 'IBM PC' byte order or a 'Mac' byte order. If you choose 'IBM PC' you will get a little-endian byte order, if you choose 'Mac' you will get a big-endian byte order. Both types of byte order are part of Baseline TIFF v6. TIFF is one of those formats that is variable or bi-endian. Both a little-endian and a big-endian byte order have advantages and disadvantages. Here the most important issue (for long-term preservation) is that every time a computer opens a file, it needs to know how the file is structured: little-endian or big-endian. The central processing units (CPU) of a computer are configured little-endian or big-endian. If the CPU is for example big-endian configured and the file is structured little-endian, the computer will first have to reverse the byte order in order to read and process the data. When exchanging files between computers with a different endianness, errors might occur when this difference is not taken into account. In the past the CPU's of Apple MacIntosh computers were configured big-endian, those of PC computers little-endian. Not only are a large majority of all computers PC's and thus little-endian configured, but also all current Apple computers are configured little-endian because they use Intel processors. Only older PowerPC based Apple MacIntosh computers are still big-endian configured (see http://developer.apple.com/library/mac/#documentation/DeviceDrivers/Conceptual/WritingPCIDrivers/endianness/endianness.html and http://www.apple.com/benl/why-mac/better-hardware/). Thus a very large majority of computers (both PC and Apple) are currently little-endian configured. This is why a little-endian or IBM PC byte order is recommended. For

file format for the archival master and production master files. This means that at some point in the digitisation workflow the RAW (or DNG, see further) will have to be converted to Uncompressed Baseline IBM TIFF v6.0. This is a standard file format accepted by ISO (International Organization for Standardization) that allows uncompressed storage of photographs. The reason that Baseline TIFF is preferred rather than RAW for archiving purposes is that RAW files require software provided by the camera manufacturer or a convertor, and that there is not as yet an open RAW format accepted by ISO as standard. Please note also that only Baseline TIFF is accepted as an archiving standard, not the extensions that are described in the TIFF standard. Not every TIFF reader supports every TIFF extension. The lossless LZW compression is part of the extensions and not of Uncompressed Baseline IBM TIFF v6.0. Although LZW compression is a form of lossless compression, it is not recommended for archiving image files.

Aside from, or instead of, this Uncompressed Baseline IBM TIFF v6.0 format, the DNG format is sometimes used as the format for the archival master file. DNG stands for Digital Negative and is an open RAW image format that is developed by Adobe.[63] It is based on the TIFF/EP standard format. Adobe has submitted DNG to ISO for incorporation into their revision of TIFF/EP. The TIFF/EP image data format is different form the standard TIFF format (Baseline TIFF v6.0). Since DNG has no long-term digital preservation path fixed yet, it cannot be recommended as a format for archiving purposes. However, if one wants to preserve one's RAW files in combination with Uncompressed Baseline IBM TIFF v6.0. copies, it is recommended to convert the RAW files from the proprietary file format to the open DNG file format.

A format that is considered by some as an alternative for TIFF is JPEG2000. JPEG2000 has smaller file sizes (thanks to its possibility of lossless compression) and wider applicable use in many more environments than DNG. Although there is still some controversy about whether JPEG2000 can yet be recommended as an archival format, it is accepted as an archival format with large-scale use by major European institutions.

8.2.2. Some quality recommendations

8.2.2.1. For the archival master file

The resolution of the archival master file:
In agreement with our *Digitise Once for All Purposes* approach we recommend the following resolution for the DCA project:
- a resolution set to capture at the highest optical pixel dimensions of the camera;
- a resolution otherwise set to capture at no less than 300 pixels per inch (ppi) (preferably for a width of 4.961 pixels if vertical or 7.016 pixels if horizontal);[64][65]
- a resolution set to capture the smallest significant detail of the object.

The bit depth of the archival master file:

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more information about endianness, see the Endianness White Paper by Intel (http://www.intel.com/design/intarch/papers/endian.pdf).
[63] Adobe provides a free Adobe DNG Converter that translates RAW files from many of today's popular cameras.
[64] This is because an archival master file with a resolution of 300 ppi and a width of 4.961 pixels if vertical or 7.016 pixels if horizontal will serve a very broad range of purposes. Because the quality requirements for printing purposes are usually much higher than the quality requirements for online display, our goal is to meet the quality requirements of the printing industry. If the quality requirements for printing purposes are met, the quality requirements for online display can also easily be met. 300 ppi is the resolution that is often used in the printing industry. For the production of prints larger than the A2 size a resolution lower than 300 ppi is often used. One can then enlarge the format size while lowering the resolution (e.g. from 300 ppi to 200 ppi) without affecting the quality of the image.
[65] The width of the A2 format is 4.961 pixels if vertical or 7.016 pixels if horizontal at 300 dpi.

The digital archival master file should be created with the highest bit depth that is both affordable and practical. It is recommended to use a bit depth of 24 or 48 bits/pixel (8 or 16 bits per channel) for colour images.[66] For greyscale images it is recommended to use a bit depth of 8 of 16 bits/pixel.[67] In some cases it is worth considering digitising greyscale images as colour images, since a lot of images are not true greyscale images but also have a (colour) hue.

The colour space of the archival master file:
As colour space for the TIFF archival master files, it is recommended to use AdobeRGB or eciRGB_v2[68]. Both are standard colour spaces for printing purposes and have a large colour range. In many cases the use of AdobeRGB will be the most practical and accessible option. It is not recommended to use sRGB or AppleRGB for the archival master files, since they have a narrower colour range (only suitable for display).

EciRGB_v2 is a free RGB profile workspace that is device independent and is developed by the European Colour Initiative (ECI), a group of experts from the publishing industry. EciRGB_v2 has been submitted to ISO standardisation and is expected to be incorporated – including a complete and detailed specification of its characteristics – into the ISO 22028 series of standards. The expected publication of eciRGB as an ISO standard will probably establish it as a worldwide RGB standard profile for use as a working colour space in the graphic arts industry. AdobeRGB is an RGB profile developed by Adobe. The main advantage of AdobeRGB is that it is default installed in all Adobe application software like Photoshop and Illustrator (and many more) and as such is very widely supported. This is not the case for eciRGB, but it can be downloaded for free from http://www.eci.org/doku.php?id=en:downloads and installed in Adobe Photoshop afterwards.[69] So, even if eciRGB is not default installed in the Adobe application software, it can still be used if one installs it oneself.

Camera manufacturers often also have their own proprietary colour profiles. For archiving purposes it is not recommended to use them.

The file format of the archival master file:

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[66] Please note that increasing the bit depth from 24 to 48 bits/pixel will double the file size.

[67] Please note that increasing the bit depth from 8 to 16 bits/pixel will double the file size.

[68] eciRGB has an important advantage compared to AdobeRGB: its D50 white point. AdobeRGB has a D65 white point. This means that AdobeRGB's white point is based on a light source of 6500K, and this increases risks of error depending on the rendering intent you use in a production workflow based on I.C.C. colour management, taking into account that the recommendations of ANSI and ISO are for a D50 lighting throughout the graphic chain. The white point of eciRGB is based on a light source of 5000K. According to the European Colour Initiative committee (ECI) eciRGB is better adapted to the requirements and output norms. ECI recommends to always use the eciRGB_v2 profile for new projects or when creating new data. This is especially true when converting from RAW data or from 16 bit image data. For existing projects and files that are not using eciRGB_v2 it is not recommended to convert them to eciRGB_v2 in order to avoid unnecessary conversion or – even more dangerous – assigning the wrong profile to the data. If you still have the need to bring your old data into the new colour space you have to perform an ICC profile conversion to the new eciRGB_v2 profile. Do not just "assign" eciRGB_V2 as the source profile, as it will lead to colour and luminance shifts.
Some other characteristics of eciRGB are:
    - it has a gamut that covers all colours that can be printed on today's printing presses - whether sheet fed or web offset, gravure or newsprint - but not much beyond (in order not to waste precision for bits that never really get used);
    - it produces a neutral grey whenever the values for Red, Green and Blue are equal;
    - it offers equidistance, i.e., equal difference between two colour values in eciRGB mirrors a perceived equal difference when these colours are seen by the human eye.

[69] eciRGB can be installed in, for instance, Adobe Photoshop in the following way:
    - in Windows, right-click a profile and select Install Profile, or alternatively, copy the profiles into the WINDOWS\system32\spool\drivers\color folder;
    - in Mac OS, copy profiles into the /Library/ColorSync/Profiles folder or the /Users/[username]/Library/ColorSync/Profiles folder;
After installing colour profiles, be sure to restart Adobe applications.

It is recommended to use the Uncompressed Baseline IBM TIFF v6.0 file format instead of a RAW file format for the archival master file. The DNG format is also considered by some as a format for the archival master file, but it is not yet accepted as a standard for archiving and thus cannot be recommended. It has no long-term digital preservation path fixed yet. If you want to keep your files in a RAW file format, it is recommended to convert them from a proprietary RAW format to the open DNG format but still keep an Uncompressed Baseline IBM TIFF v6.0 file. A format that is considered by some as an alternative for TIFF is JPEG2000. JPEG2000 has smaller file sizes (thanks to its possibility of lossless compression) and wider applicable use in many more environments than DNG. Although there is still some controversy about whether JPEG2000 can yet be recommended as an archival format, it is accepted as an archival format with large-scale use by major European institutions.

8.2.2.2. For the production master file(s)

The resolution of the production master file(s):
It is recommended to keep the resolution (and size) of the archival master file, preferably at a minimum 300 ppi with a width of 4.961 pixels if vertical or 7.016 pixels if horizontal (depending on the size of the archival master).[70]

The bit depth of the production master file(s):
It is recommended to keep the bit depth of the archival master file, 24 or 48 bits/pixel (8 or 16 bits per channel) [71] for colour images and 8 of 16 bits/pixel[72] for greyscale images.

The colour space of the production master file(s):
As colour space for the production master file(s), it is recommended to use AdobeRGB or eciRGB_v2. Both are standard colour spaces for printing purposes and have a large colour range. It is not recommended to use sRGB or AppleRGB for the production master files, since they have a narrower colour range (only suitable for display).

EciRGB_v2 is a free RGB profile workspace that is device independent and is developed by the European Colour Initiative, a group of experts from the publishing industry. AdobeRGB is an RGB profile developed by Adobe. The big advantage of AdobeRGB is that it is default installed in all Adobe application software like Photoshop and Illustrator (and many more). This is not the case for eciRGB, but it can be downloaded for free and you can easily install it yourself. eciRGB has an important advantage over AdobeRGB: its D50 white point. AdobeRGB has a D65 white point. This means that AdobeRGB's white point is based on a light source of 6500K, which increases risks of error depending on the rendering intent you use in a production workflow based on I.C.C. colour management, taking into account that the recommendations of ANSI and ISO are for D50 lighting throughout the graphic chain. The white point of eciRGB is based on a light source of 5000K.

Camera manufacturers often also have their own proprietary colour profiles. For archiving purposes it is not recommended to use them.

Please note that only RGB images are part of the Uncompressed Baseline IBM TIFF v6.0 archiving standard, and not CMYK images. Every CMYK file should always be considered as a derivative file of the AdobeRGB or eciRGB archival or production master file and thus be made from the RGB archival or production master. This should also be the case when one prefers to create a CMYK 'master'. Even if one's main digitising purpose is offset printing, it is

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[70] The width of the A2 format is 4.961 pixels if vertical, 7.016 pixels if horizontal at 300 dpi.
[71] Please note that increasing the bit depth from 24 to 48 bits/pixel will double the file size.
[72] Please note that increasing the bit depth from 8 to 16 bits/pixel will double the file size.

recommended to always create and archive the AdobeRGB and eciRGB archival and production master files, because these are the real masters for long-term preservation purposes – not the CMYK file. If one creates a CMYK 'master' file, it should be considered a derivative file, and one that in contrary to the AdobeRGB and eciRGB archival or production master file does not meet the requirements for digital archiving.[73] Also always avoid a conversion from a CMYK colour space back to AdobeRGB or eciRGB_v2 colour space because the colour range of the CMYK colour spaces is smaller than that of the eciRGB_v2 and AdobeRGB colour spaces.

The file format of the production master file:
Master files of all types (i.e., both the archival masters and the production master files) have permanent value for the digitising organisation and should be managed in an appropriate environment, e.g., one in which read and write executions are minimised and other preservation-oriented data management actions are applied. Therefore it is also recommended to use the Uncompressed Baseline IBM TIFF v6.0 file format for production master file(s).[74]

8.2.2.3. For the derivative file(s)

The resolution of the derivative files:
The minimum requirement recommended for the creation of the following derivative files from the eciRGB or AdobeRGB production master:
- RGB: 300 ppi with a width of 1.748 pixels if vertical and 2.480 pixels if horizontal:[75] for internal (intranet) use (e.g. in the framework of scientific research);
- RGB: 72 ppi with a minimal width of 298 pixels if vertical and 421 pixels if horizontal:[76] for web publishing;
- RGB: 72 ppi with a width of 200 pixels: for the DCA project and provision to *Europeana*.
- CMYK: 300 ppi with preferably a width of 4.961 pixels if vertical or 7.016 pixels if horizontal [77] (or smaller, depending on the size of the RGB production master and the actual print size): for offset printing.

The bit depth of the derivative files:
One can keep the bit depth of the production master file. However, it is accepted (and in some cases also recommended, especially for online display) to reduce the bit depth to 24 bit or even 8 bit depending on the starting bit depth being higher. Lowering the bit depth reduces file size and enables wide Web use while the visible loss of image quality remains limited (and remains in the best case unnoticed). For high-quality printing purposes (like offset printing) it is not recommended to reduce the bit depth.

The colour space of the derivative files:
For display purposes it is recommended to create derivative files with a RGB colour space: sRGB for Windows and AppleRGB for Mac. If one creates a CMYK derivative file, one should

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[73] During the course of the DCA project there was a discussion within the Technical Management Group of the DCA Consortium whether a CMYK derivative file is part of the level of the production master file(s) or part of the level of the derivative file(s). A CMYK derivative file is only required for offset printing, and it is not suitable for display, online access or long-term preservation. Since it is not suitable for digital archiving, the argument can be made that a CMYK derivative file should not be part of the archival system and not be considered as a production master file, but as a normal derivative file. If a CMYK derivative file is created, the ISO 12647-v2 profile is recommended for offset printing.
[74] Only RGB images are part of the Baseline TIFF v6.0, NOT CMYK images; they are only part of the TIFF v6.0 extensions.
[75] The width of the A5 format is 1.748 pixels if vertical, 2.480 pixels if horizontal at 300 dpi.
[76] The width of the A6 format is 298 pixels if vertical, 421 pixels if horizontal at 300 dpi.
[77] The width of the A2 format is 4.961 pixels if vertical, 7.016 pixels if horizontal at 300 dpi.

use the ISO 12647-v2 profile workspace. In any case always avoid a conversion from ISO 12647-v2 to eciRGB_v2 or AdobeRGB colour space because the colour range of the ISO 12647-v2 colour space is smaller than that of the eciRGB_v2 and AdobeRGB colour spaces.

<u>The file format of the derivative files:</u>
For offset printing purposes it is recommended using the TIFF file format. For other display and (online) access purposes it is recommended to use the JPEG file format.

8.3. Quality parameters for moving image files

8.3.1. General quality parameters for moving image files

Moving image files can have several components:
- one or more video components or streams;
- one or more audio components or streams;
- video and audio codecs;
- subtitles in different languages;
- metadata;

A moving image file that contains silent video will contain no audio component.

The quality parameters of the video component are:
- the file format;
- the codec;
- the compression;
- the bit depth;
- the horizontal frame size, i.e., the number of horizontal pixels (or the number of pixels of one video line);
- the vertical frame size, i.e., the number of vertical pixels (or the number of horizontal video lines);
- the frame rate, i.e., the refreshing rate of the image;
- the frame type, i.e., the information that indicates whether interlacing or progressive scanning is used;
- the field order, i.e., the information that indicates which field is displayed first;[78]
- the frame aspect ratio, i.e., the aspect ratio of the image frame (or field);
- the pixel aspect ratio;
- the colour space;
- the chroma sub sampling.

The quality parameters of the audio component are:
- the codec;
- the compression;
- the bit depth;
- the sample rate;
- the number of audio channels.

8.3.2. Some specific characteristics of moving image files

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[78] This is only important for interlaced video. A wrong field order affects the quality.

Whether playback of digital audio and video is possible or not does not only depend on the support of the file format. After all, most file formats for audio and video are wrapper or container formats. Within this kind of file format different kinds of codecs are used. The codec is a device or computer programme capable of encoding and/or decoding a digital data stream or signal. One wrapper or container format can contain different streams and in principle a different codec can be used for each stream. Whether playback of digital audio and video is possible depends not only on the choice of the file format but also on the choice of the codec. If one decides to use a proprietary codec (like the ones used by the popular Blackmagic and AJA capture boards), one will need to take into account that this choice creates a bigger risk for the long-term preservation of the digital files than the use of an open codec. One will have to closely monitor the evolution of the support of the proprietary codec and be prepared for a future transcoding of the files when the support of the proprietary codec stops. Digital files in a proprietary codec can be transcoded to an open codec, but every transcoding process contains a risk of losing information, which creates new costs.

Codecs are typically used for the compression of data in audio and video. There are two types of compression: 'lossy' compression and lossless compression. The information loss that is linked to 'lossy' compression usually also results in a loss of quality.

The bit depth for the video and audio component is the number of bits used to define the video and audio information.

Every video image (or frame) consists of a series of horizontal image lines. Each horizontal image line consists of a number of pixels. A Standard Definition video image consists of 576 image lines, and each of these lines consists of 720 pixels.[79] Each video frame is refreshed with a certain speed; according to European standards this speed is 25 images/second (according to American standards this is 29,97 images/second). It is possible that a video frame consists of two different fields. These fields each contain half of the image lines. According to European standards they are refreshed at a speed of 50 fields/second. If the video frame consists of two different fields, it is called *interlaced*. If the video frame is not interlaced, it is written by *progressive scanning*. If the *upper* field is displayed prior to the *lower* in the case of interlacing, the field order is *upper field first*. If the *lower* field is displayed prior to the *upper* field, the field order is *lower field first*. When the fields are displayed in the wrong order, the image becomes shaky.

The aspect ratio is the ratio of the width of the image to its height, expressed as two numbers separated by a colon. Its is written as width:height (x:y). The common aspect ratios are 4:3 (standard) and 16:9 (widescreen). The pixel aspect ratio is the ratio of the height of pixel to its width, also expressed as two numbers separated by a colon. It is written as width:height (y:x). The common pixels aspect ratios in the video world are 59:54 (standard image, Rec.601) or 12:11 (standard image, digital) and 118:81 (widescreen image, Rec.601) or 12:11 (standard image, digital).

In analogue video the video signal can have different forms:
- RGB;
- component video;
- composite video;
- Y/C.
Each of them composes the video signal in a different way. The way the colour information is organised in a digital video signal is based on the component video signal. In analogue component video it is called YPbPr, in digital video it is called YCbCr. Y is the luma component (luminosity) and Cb and Cr are the blue-difference and red-difference chroma components

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[79] In analogue video 625 image lines (of which 576 visible) are used in PAL (mainly Europe), and 525 image lines (of which 480 visible) in NTSC (mainly USA, Canada and Japan).

(chrominance). YCbCr is not an absolute colour space, it is a way of encoding RGB information. The component system also forms the base of the 4:2:2 standard that is used for chroma subsampling systems in digital video. With 4:2:2 sampling all four luminance pixels are sampled, but only two Cr pixels and two Cb pixels.

The sound component of video will consist of different audio channels. Mono contains one channel, stereo two. Videotapes for professional use can often contain more than two channels, for instance four.

8.3.3. Some quality recommendations

8.3.3.1. Quality recommendations for the archival master file

The quality parameters of the video component are:
- the file format: use an open container format; recommended formats are MXF, MJPEG2000, Matroska, AVI, or MOV ; MXF, MJPEG2000 and Matroska are recommended above the use of AVI and MOV because both formats are standardised and offer support for the storage of metadata;
- the codec: the use of an open codec (like MJPEG2000 or FFV1) is recommended above the use of a proprietary codec – if you use a proprietary codec (like the codecs used by the popular video capture boards of AJA Video Systems of Blackmagic design closely monitor the evolution of the support of the proprietary codec and foresee the possible necessity of a future transcoding to an open codec;[80]
- the compression: it is recommended to store the archival master file uncompressed or with a lossless compression;
- the bit depth: it is recommended to use 10 bits;
- the horizontal frame size: the horizontal frame size for Standard Definition is 720 pixels, the horizontal frame size for High Definition is 1280 (720p) or 1920 (1080i or 1080p) pixels – it is not recommended to blow up or reduce the frame size of the original;
- the vertical frame size: the vertical frame size for Standard Definition is 576 image lines in Europe and 480 or 486 image lines in the USA, Canada and Japan,[81] the vertical frame size for High Definition is 720 (720p) or 1080 (1080i or 1080p) pixels – it is not recommended to blow up or reduce the frame size of the original;
- the frame rate: it is recommended to keep the frame rate of the original – i.e., no transcoding from, for instance, PAL to NTSC or from NTSC to PAL;
- the frame type: it is recommended to keep the frame type of the original – avoid de-interlacing if the original was interlaced, and avoid deinterlacing if the original was interlaced;
- the field order: it is recommended to keep the field order of the interlaced original;
- the frame aspect ratio: it is recommended to keep the aspect ratio of the original;
- the pixel aspect ratio: this will usually be 59:54 or 12:11 (for a 4:3 image) or 118:81 or 12:11(for an anamorphic 16:9 image) (see above);
- the colour space: this will usually be 4:2:2;
- the chroma sub sampling: this will usually be YCrBr.

The quality parameters of the audio component are:
- the codec: the use of LPCM is recommended;
- the bit depth: 16 bits is recommended;

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[80] It is recommended to use a (lossy) DV codec if the originals are (digital) DV tapes, or a (lossy) MPEG-2 codec if the originals are DVDs.
[81] 480 image lines for NTSC DVDs and DV and 486 image lines for NTSC Broadcast.

- the sample rate: 48KHz is recommended;
- the number of audio channels: it is recommended to keep the original number of audio channels – when the original is in mono, use two channels.[82]

These parameters can be different for video recordings that are made with a video camera instead of a video capture board or stand alone digitisation device. When made with a video camera, they are defined by the camera itself.

8.3.3.2. Quality recommendations for the production master file(s)

While for the image files the chromatic corrections are only done after the capture, this is not always the case for moving image files. The colours of the video signal can be corrected by adjusting the TBC or colour corrector prior to digitisation. Also the sound can be corrected by adjusting the equipment prior to digitisation. In cases of digital restoration (e.g., noise reduction and image cropping[83]), there will be a production master file that differs from the archival master file. It is recommended to use the same quality parameters for the production master file as the archival master file.

8.3.3.3. Quality recommendations for the derivative file(s)

There are currently no elaborate recommendations for derivative files. Also *Europeana* has no special guidelines for moving image files, since the portal will not harvest them. It only harvests links to moving image files. We recommend the use of file formats and codecs that have no licensing restrictions and that can be played by every common web browser.[84]

It is recommended to deinterlace the video file if the original was interlaced.

It is worth considering the creation of a still image from the moving image files. The recommendations for these are:
- JPEG, sRGB or AppleRGB, 72 ppi based on the original size of the video image[85]: for web publishing and other purposes;
- JPEG, sRGB or AppleRGB, 72 ppi with a width of 200 pixels: for the DCA project and provision to *Europeana*.

8.4. Quality parameters for audio files

8.4.1. General quality parameters for audio files

For background information on the quality parameters of audio files, please consult the information above on the audio component of video files.

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[82] Considering the fact that most modern formats support at least two channels, it is a good practice to copy mono sound to both channels for safety reasons. However, this does not result in stereo sound since the sound on both tracks is identical.
[83] Just crop the mask outside the image, do not change the size or scale of the image.
[84] Some DCA partners recommend the use of h.264 video in combination with aac (mp4) audio.
[85] It might be required to stretch the still image from 720 to 768 or 1024 pixels to get the original aspect ratio in case of PAL video.

8.4.2. Some quality recommendations

8.4.2.1. Quality recommendations for the archival master file

The quality parameters are:
- the file format: it is recommended to use WAVE or AIFF as file format;
- the codec: it is recommended to LPCM codec;
- the compression: it is recommended to use no compression;
- the bit depth: it is recommended to use a minimum bit depth of 16 bits;
- the sample rate: it is recommended to use a sample rate of 48 KHz;
- the number of audio channels: it is recommended to keep the same number of channels as the analogue original – when the original is in mono, use two channels.[86]

8.4.2.2. Quality recommendations for the production master file(s)

While for the image files a master file is necessary because the chromatic corrections are only done after the capture, this is normally not the case for audio files. The audio signal can be corrected by adjusting the equipment prior to digitisation. In cases of digital restoration (e.g., noise reduction), the production master file might differ from the archival master file. It is recommended to use the same quality parameters for the production master file as the archival master file.

8.4.2.3. Quality recommendations for the derivative files

There are currently no elaborate recommendations for derivative files. *Europeana* has no special guidelines for audio files either, since the portal will not harvest them. It only harvests the links to audio files. We recommend the use of file formats and codecs that have no licensing restrictions and that can be played by every common web browser.

8.5. File naming

The file name consists of a series of characters that make it possible to identify the file. Detailed guidelines for the naming of the files will follow in *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks* and/or *D6.1 Guidelines for a long-term preservation strategy for digital reproductions and metadata.*

A minimum requirement is that clear agreements are made about the structure of the file name, and also if one works with a subcontractor.

It is recommended not to use meaningful file names because they might hamper an efficient digitisation workflow. A complex name can raise the digitisation cost because it is more time-consuming. If possible, use meaningless file names.[87]

It is important that all files names are unique.

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[86] Considering the fact that most modern formats support at least two channels, it is a good practice to copy mono sound to both channels for safety reasons. However, this does not result in stereo sound since the sound on both tracks is identical.
[87] On the other hand, meaningful file names can help identifying them. DCA partner LIMA (formerly NIMk) uses a software programme to generate meaningful and machine-readable file names.

It is also recommended to avoid the use of special characters like punctuation marks, hyphens, brackets… File names should contain only the letters of the Latin alphabet, the numericals 0 to 9, or a combination of both. Special characters often have a special meaning for data processing scripts and software, and can produce unpredictable results. Only the use of underscores is safe. They can be used to replace spaces between characters that need to be avoided.

9. Digitisation

9.1. Digital (reproduction) photography[88]

9.1.1. General digital (reproduction) photography workflow

Since the largest part of the digital reproductions created within the framework of DCA and digital (reproduction) photography is something that to some extent can be done by collection caretakers themselves if they have staff members with photography skills and photography equipment in-house,[89] this chapter largely focuses mainly on digital (reproduction) photography.

The digital (reproduction) photography process itself can be divided in different steps. The AIC Guide to Digital Photography and Conservation Documentation contains the following interesting flowchart:[90]

1. Photography setup before capture
One time setup:
      - Decision making for equipment, software, lighting, etc.
      - Software settings on computer.
Every time:
      - Setup camera equipment and lighting. Place object.
      - Choose target(s).

2. Image capture
      - Decide on tethered or untethered capture.
      - Check camera and/or software setting.
      - Take images.
      - Transfer images to computer.

3. Image processing
      - Process images using RAW processing software.
      - Rename images.
      - Add metadata.
      - Save RAW images in the TIFF format.

4. Image management
      - Decide on a folder structure for saving your archival files and preferred file format(s).
      - Back up the image files.
      - Maintain the archive of image files using digital asset management software.
      - Develop a migration strategy.

5. Output (optional but recommended)

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[88] Additional information related to this section can be found in
- FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), 224 p.
- ADF and ECI, *DIGIPIX 3 – Compendium for digital photography*, 2006, 101 p.,
http://www.eci.org/doku.php?id=en:downloads
[89] In most cases subcontracting is still recommended and required to reach a high-quality level.
[90] FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 20

- Print images as contact sheets.
- Store in the object file under stable environment conditions.

This section of *D4.2 Guidelines for an A-Z digitisation workflow of contemporary artworks* mainly focuses on steps 1-3, and is largely based on the AIC Guide to Digital Photography and Conservation Documentation.

9.1.2. Digital (reproduction) photography equipment

9.1.2.1. Cameras[91]

There are three main categories of cameras available for the creation of digital reproductions:
- point-and-shoot cameras;
- digital single lens reflex cameras (DSLR);
- medium format cameras and scanning back cameras.
It is suggested that serious consideration be given to the highest-quality camera system one's budget can accommodate. The image quality is determined largely by sensor resolution and size, as well as lens optics. Within the DCA project we did recommend not using point-and-shoot cameras. They are more appropriate for installation, gallery and working shots than for the creation of high-quality digital reproductions.

In many cases a DSLR camera will be the most affordable option. AIC's recommendations for a DSLR camera are:
- 10-12 megapixel (MP) (or greater) recommended native sensor pixel count (camera or sensor resolution);
- ability to shoot RAW and/or TIFF formats, not only JPEG;
- accepts interchangeable lenses;
- sensor size roughly 23 x 15 mm (APS-C or Type1.8") or greater, with an aspect ratio of 3:2;
- ability to tether to a computer;[92]
- live view capability;
- support for Adobe RGB (1998) colour space, not sRGB (when shooting in TIFF or JPEG mode).

Two crucial factors for the determination of how many megapixels are needed for a particular photograph, are:
- the desired size of the printed image, or the desired size of the image when viewed on a monitor or projection screen (i.e., the size of output);
- the resolution of the printer or of the monitor or projector (i.e., the resolution of the 'output device').

Within the DCA project we preferred a higher amount of megapixels than AIC's recommendations (minimum 18 instead of 12 MP) and also full-frame sensors when using DSLR cameras. Full-frame sensors are twice the size of APS-C type sensors. They provide increased sensitivity, less noise and greater dynamic range. If possible, we recommend opting for an output size with a width of 4.961 pixels if vertical or 7.016 pixels if horizontal. This width corresponds to the width of the A2 format at 300 dpi (the resolution of high-quality offset printers).

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[91] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 21-30
[92] This means that the camera or camera back needs to be connected to a computer.

Thus, quality-wise medium format digital cameras are a better option for the production of high-quality reproductions than DSLR cameras. Unfortunately they also provide a higher image quality at a significant increase in cost. If one's budget allows it and digital reproductions of the highest quality are expected, it is recommended to use a medium format digital camera. Their sensors are considerably larger than those of full-frame DSLR cameras and provide much higher resolution, less noise and greater sensitivity with larger individual pixels. Medium format digital cameras are typically tethered to a computer and used in a photo studio with controlled lighting. Some medium format digital camera models have a multi-shot mode to effectively eliminate colour interpolations. A multi-shot is not necessary for many circumstances, but might be recommended when very high detail capture and accurate colour capture are crucial (e.g., for certain digital reproductions of paintings).[93]

Scanning back cameras are also often beyond the budgets of collection caretakers. They offer very high resolutions at a lower cost than medium format digital cameras. Scanning backs are used in large format cameras and can only be used when tethered to a computer.

Most digital cameras have two format modes to choose from when photographing: either RAW or JPEG. Some high-end DSLRs and medium format camera systems also offer a TIFF mode or Adobe's DNG RAW file format as an alternative to the camera manufacturer's proprietary RAW format.

9.1.2.2. Memory cards[94]

A memory card is an electronic flash memory data storage device that is used to store and transfer digital information. It is required for digital cameras, with the exception of when shooting tethered. The most common types for digital cameras are CompactFlash (CF) and Secure Digital (SD). The competition between the two formats is currently in favour of SD. There are two types of CF card: Type I and Type II cards. Type I cards are more commonly sold than Type II cards. There are different versions of SD cards, for instance miniSD, microSD, SDHC and SDXC. Check your camera specifications or manual to purchase the correct card type (also capacity, speed, …). The speed of the card may affect the speed of the shooting and afterwards the data transfer. Avoid cards that do not list the read and write speed or class. Always buy memory cards from reputable vendors.

9.1.2.3. Lenses[95]

The focal length of a lens determines the field of view that it projects onto film or sensor in a camera. We usually make a distinction between wide-angle, normal and telephoto lenses, depending on their focal length and how the projected fields of view relate to that of the human

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[93] Multi-shot technology takes four successive photographs, moving the entire sensor one pixel up, one pixel to the right, one pixel down and one pixel left for each of the four exposures, and then joins the four images into a single shot. This means that each photo site in the sensor can capture more information about the subject. The Hasselblad H4D-50MS camera and the Sinarback eVolution 86 H digital back use, for instance, the multi-shot technology. Unfortunately, this type of camera also has some disadvantages: it is very expensive equipment, it requires a skilled photographer, the camera needs to be tethered (which might be an impediment for certain kinds of field work), the subject is not allowed to move and the light may not change during the time that it takes to make the multiple exposures (which eliminates photographing subjects such as kinetic installations or audio-visual works or photographing in open air with changing daylight and wind).

[94] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 30-32.

[95] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 32-37.

eye. Traditional focal length classifications are based on film cameras. To help consumers relate the film-based focal length of lenses with cropped sensor DSLR cameras, manufacturers provide a multiplication factor called the "focal length multiplier" (FLM) or "field of view crop". A smaller sensor results in a larger FLM number. Besides offering higher-quality image results, a full-frame DSLR is advantageous compared with an APS-C sensor camera because its shooting distance will be smaller due to the larger sensor. This might be practical when using a copy stand or when working in a smaller photography area.

DSLR cameras are typically sold either as just the body or as a kit, in which the body is packaged with a zoom lens. While zoom lenses are often convenient, those that are part of a kit are typically less expensive models and often somewhat slow. In general prime lenses are usually faster than zoom lenses, allow the use of lower light levels and have better optics that can produce sharper images.

The lens speed is the measure of brightness of the image projected on the sensor when the lens's aperture is open. Fast lenses are generally more expensive and of higher quality than slower lenses. Lens speed is usually not a factor when working on a tripod, as any F-stop and shutter speeds can be selected without risk of camera movement. However, one should keep in mind that photographic lenses generally perform best (give the sharpest results) when the lens aperture is closed down two or three stops from fully open. Unless significant depth of field is required, one should also avoid using the very smallest aperture settings because this can also make the image less sharp.

Keep in mind that wide-angle lenses, often used when one cannot move the camera far enough back to fill the entire subject within the image frame, lead to varying degrees of unwanted barrel distortion to the subject. Zoom lenses might lead to pincushion distortion at longer focal lengths. Although lens correction tools are available in image editing software, major corrections to image distortion are generally not recommended for the permanent conservation of documentation images.

9.1.2.4. Lighting equipment[96]

The ideal light source would be continuous and inexpensive, with low heat output, a daylight colour temperature, and a smooth and spike-free spectral curve. Since no light source exists with all of these qualities, the choice of lighting is a compromise between factors such as the budget, the relative sensitivity to heat of the objects photographed, and the importance of colour accuracy. Three commonly used light sources for digital photography in art conservation are 'full spectrum' fluorescent light banks, incandescent, and strobe (multiple external electronic studio or portable flash units).

Standard colour temperatures of common photographic light sources range from warm (reddish) tungsten (3.200° K) to cool (bluish) daylight (generally 5.000° K or 5.500° K), although there are also many incandescent and non-incandescent photographic lamps available with colour temperatures between these that can be used. The ability of digital cameras to adjust their colour balance (white balance) precisely to the light source without resorting to the use of filters is one of the great advantages of digital photography. Avoid mixed lighting when optimum colour accuracy is desired (e.g., avoid photographing in an area with tungsten lamps and natural light or fluorescent light). Although digital cameras offer

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[96] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 38-42 and p.110.

greater flexibility in adjusting the colour temperature of lighting, they are not always able to maintain colour accuracy with mixed light sources.

Professional photographers often prefer studio strobe units. Along with portable flash units, they provide a daylight colour temperature, high lumen output without heat, and either focused or diffuse illumination. Most strobe units have a modelling light within the lamp housing that provide a suggestion of the character of the illumination that will strike the subject when one presses the shutter release. When shooting with studio strobe units or portable flash units, it is imperative to work with units that are totally consistent, and the timing of the exposures should be such that the strobes have time to fully charge before each exposure.

Photographic lights can cause photochemical and thermal damage, or cause structural damage by bringing about rapid fluctuations in relative humidity. One should keep the artwork's or contextual document's sensitivities in mind when choosing lighting equipment. AIC recommends keeping the illuminance levels at the object surface below approximately 200 foot-candles (2152lux), and to keep ultraviolet content below 75µW/lumen (zero ultra-violet output is preferable). Be aware that incandescent lamps have heating effects. Lamps should be turned on only when necessary. Non-incandescent sources may require a short amount of time to stabilise after being switched on before use. If the reproduction photography is done in a small room, special attention should be given to changes in ambient temperature and consequent relative humidity fluctuations.

9.1.2.5. Greyscale and colour targets[97]

A greyscale and, if possible, a colour target should be included in conservation documentation images. Targets act as technical metadata by providing known RGB values within the image. Targets also provide a visual reference for the viewer. Although it is common to crop targets out of images for presentation or distribution, the master file should retain this important reference within the image frame.

Standardised greyscale targets are used to check exposure and white balance since there are known RGB values (for a particular colour space) for the patches. AIC's recommendations for targets are:
- ideally, R,G and B values should be identical for any non-chromatic patch (e.g., black, white, and grey);
- no optical brighteners;
- non-glossy surface;
- non-polarising;
- target patches should ideally be painted or produced by a continuous-tone process;
- numerical RGB or Lab (also expressed as CIA L*a*b* or CIELAB) values should be provided by the manufacturer. Ideally, these values should be printed or written next to the patches (self-describing) so that future users will know the intended values;
- RGB values should be consistent from target to target, unless they are self-describing;
- greyscale targets should maintain a neutral colour appearance under different lighting conditions.

X-Rite ColorChecker Classic is preferred above others. It meets the specifications stated above and is also widely used by professional photographers. X-Rite ColorChecker Digital SG is a larger target that is intended primarily for camera profiling, although it can be included

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[97] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 42-47.

within conservation documentation images of large subjects or used for white balancing. The X-Rite ColorChecker Passport contains the regular ColorChecker patches, in addition to a set of Photo Enhancement patches and a larger white balancing patch in a hard plastic case. It is designed for use with X-Rite ColorChecker Passport DNG camera profiling software. A product that is similar to this ColorChecker Passport is the Datacolor Spyderchecker.

The Kodak colour and greyscale guides have long been the guides for film photography. With the advancement of digital photography, a number of limitations were noted in the Kodak guides. The Color Separation Guide was designed as a reference for colour separation printing. Its patches, printed in cyan, magenta, yellow and black inks, are not light stable, not always consistent between different cards and the manufacturer does not provide RGB or Lab values for the patches. Although it has been widely used for film-based photography, it is not recommended for repro photography. The Kodak Grey Scale targets can be neutral, but the manufacturer does not necessarily maintain consistency between targets, and there are better options available for reproduction photography.

9.1.2.6. Monitors[98]

Since high-quality CRT displays are no longer manufactured for imaging purposes, most practitioners will use an LCD monitor. A good quality LCD monitor is important if one intends to assess or make other adjustments than white balance and expose adjustments[99] to images. A high-end monitor will improve one's ability to see a wider range of colours more accurately with smother gradations in tone. This will be most noticeable in subtle variations of the lightest and darkest colours and might be required for colour corrections for high-end printing purposes. Manufacturers such as Eizo, Quato, LaCie and NEC offer high-quality graphics monitors. Ideally, all monitors – expensive and less expensive – should be calibrated and profiled with a hardware profiling device.

AIC's recommendations for monitors are:
  - a wide viewing angle – at least 178° both vertically and horizontally – is very important;
  - a contrast ratio of 300-500:1;
  - a luminance capability of at least 200-400 cd/m^2. Note that the actual brightness level during use should range from 120-140 cd/m^2. The brighter luminance capability recommended will allow the user to compensate for diminishing brightness as the monitor ages;
  - capable of displaying 16.7 million colours;
  - a shade attachment option to reduce glare. Avoid using non-glare filters on one's monitor;
  - a matte surface is preferable to a glossy surface.

Not only the quality of the monitor is important, but also the viewing conditions. AIC's recommendations to improve the viewing conditions are:
  - do not place your monitor directly in front of or directly across from a window;
  - use window blinds to reduce the amount of light near the monitor;
  - use low-level task lighting rather than overhead lighting;
  - to prevent reflections from interfering with viewing and colour perceptions, do not wear bright colours or place brightly coloured materials near the monitor;
  - set the monitor background colour to grey.

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[98] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 47-48.
[99] These should be made using standardised greyscale targets.

9.1.2.7. Printers[100]

Although printing is not really part of the DCA project, we include a short section about printers because printers might be used as a tool in the colour correction process. There are two primary methods for making (archival) hard copies of reproductions: inkjet printing and traditional chromogenic printing.[101] Since chromogenic printing requires sending out the digital files to a photo-finishing lab, we will not discuss it further because it will not be used as part of the colour correction process.

AIC's recommendations for inkjet printing are:
- choose a printer, ink and paper combination recommended by the manufacturer;
- dye-based inkjet prints can have good image stability but are generally more susceptible to moisture and atmospheric pollutants than pigment-base inkjet prints;
- avoid third-party inks, which are known to have low image stability; this includes third-party refillable ink cartridges;
- although most papers today are fast drying, be sure to allow prints to dry for the recommended time before stacking them or placing them in sleeves;
- prints should be stored in archival polyester, polyethylene or polypropylene sleeves. This will protect the surface from abrasion;
- some glossy and semi-matte papers have a wider colour gamut, higher Dmax (darker blacks), and allow higher printing resolution than some matte papers. Nevertheless, the choice between glossy, semi-matte, or matte is often determined by personal preference.

It is important to take the last recommendation into consideration when inkjet printing is used as part of the colour correction process. The other recommendations are important to take into consideration when an inkjet printer is used to make archival prints.

An important aspect to take into account is the use of ICC printer profiles (see *9.3.4. Printing and colour management*). Many manufacturers offer ICC printer profiles designed for their printer and paper combinations through their websites.

9.1.2.8. Software[102]

Software is a necessary expense that must be factored into any digital photography setup.

Capture software is used to tether one's camera to a computer so that images are transferred directly to the computer and displayed on the computer monitor as one takes them. This provides more accurate image assessment to evaluate framing, focus, and exposure than can be accomplished when viewing the image on the camera's small LCD screen. Recent versions of capture software also allows one to take advantage of live view, a feature available on more recent DSLRs that allows one a 'live view' of the subject not only through the optical viewfinder but also on the camera's LCD. When a camera is tethered to a computer, this feature can be available within a separate window on the monitor, making it more convenient to evaluate framing and focus before actually taking a photograph. For instance Canon, Nikon, Sony and Fujifilm provide capture software to control and view the live view images on the computer.

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[100] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 48-50.
[101] Colour laser printers are often used for printing installation, gallery and working shots as well as text documents, for which colour accuracy and image permanence are not as critical as in archival hard copies of digital reproductions.
[102] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 50-59.

There are also a variety of free tethering software applications available, but they do not offer the full range of control over camera functions, making them less useful.

Whether one tethers the camera to the computer or not, RAW processing will need software to open and process RAW files (to TIFF, JPEG or other formats) from the camera. Each camera manufacturer provides proprietary software for this. Adobe has developed a plug-in for Adobe Photoshop, Adobe Lightroom and Photoshop Elements to read and process the proprietary RAW formats of different camera manufacturers.

Image editing software should support metadata, colour management and RAW file processing. Image editing software supplied by the camera manufacturers may or may not produce the best results, or be the most user-friendly. Some well-known proprietary image editing software is Adobe Photoshop, Adobe Photoshop Lightroom, Adobe Photoshop Elements, Apple Aperture and Corel PaintsShop Photo Pro. Examples of free image software for both Windows and Apple OS X includes XnView and GIMP.

If one takes photographs with a camera set to RAW mode, the RAW files from the camera will be in a RAW format specific to the camera manufacturer. Unlike proprietary RAW formats, Adobe DNG is a free, openly documented RAW format and has some advantages related to archival storage over camera manufacturers RAW formats. DNG conversion software is needed to convert proprietary RAW files to the DNG format. Adobe DNG Converter is a free utility that will make this conversion.

9.1.3. Support systems and background[103]

An appropriate system for supporting objects during photography is essential to ensure their safety. A support system should allow one to standardise the procedures and provide minimal restrictions in light positioning.

For two-dimensional or flat objects one can use, for instance:
- a wall-mounted or rolling floor easel: this works well for most paintings or similar self-supporting works that have a strainer, frame or rigid backing, and create few restrictions to lighting placement;
- copy stands: these are commonly used for smaller, two-dimensional objects, place restrictions on light placement and have limitations on the size;
- a slant board or tilt table: can be used for large, flat objects that are not self-supporting, present few restrictions to lighting placement but framing and adjusting the camera and subject to be parallel with each other can be difficult.

For three-dimensional objects one can use:
- a professional shooting table designed for commercial photography: this is recommended for photographing small to medium-size objects;
- the floor can be used for larger freestanding pieces;
- copy stand: these can be used for small, non-freestanding objects.

A neutral grey or black matte background is recommended for most subjects. For three-dimensional objects neutral grey is recommended because black backgrounds tend to blend into the shadows along the subject's contour, thus obscuring the object's true edge. One should avoid coloured backgrounds because they can affect the apparent colour of the

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[103] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 110-112.

subject. White backgrounds can create flare and loss of contrast, especially with darker subjects.

9.1.4. Illumination[104]

For the creation of digital reproductions one usually uses a normal or reflected illumination. This type of illumination provides a record of the appearance of the object as seen under standard viewing conditions. Generally, this means using relatively flat and uniform illumination, with minimal surface glare, although this can vary depending on the object.

AIC's recommendations for normal illumination of two-dimensional objects are:
   - for relatively flat objects with pronounced texture diffuse sources, or a combination of diffuse and a single focused source, are generally best in order to avoid creating confusing sets of double shadows;
   - to minimise surface glare the light sources should be positioned approximately 25° from the surface plane of the subject (the often mentioned 45° in photographic manuals will nearly always result in unacceptable glare on any reflective surface unless other measures are taken);
   - to achieve uniform illumination across a subject's surface, position the light sources as far from the subject as possible and aim them slightly beyond the far edges of a relatively flat object, not at its centre;
   - using barn doors on the light sources can further help even the illumination and prevent light from striking the camera lens;
   - if working on a copy stand, a lens hood or lens shade is essential.
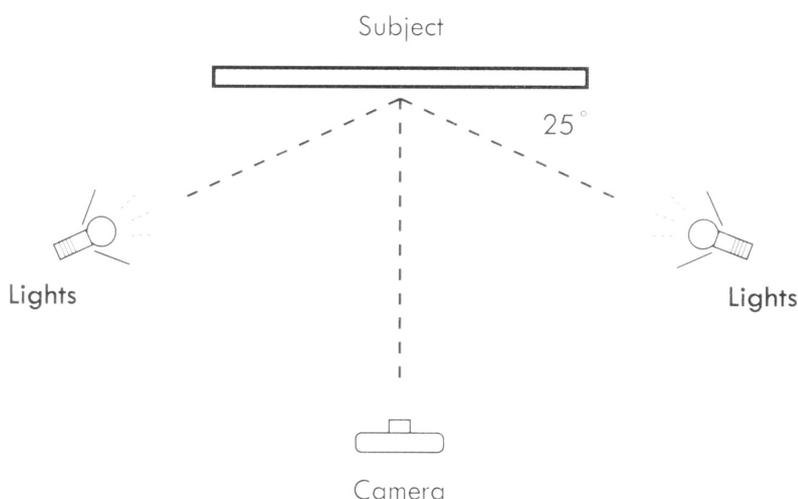
AIC's recommendations for normal illumination of three-dimensional objects are:
   - primary lighting should be from diffuse sources (for instance two photographic softboxes).To bring out surface details or to better separate the edge of the subject from the background, a non-diffuse source can be added (for instance placed above, to the side and slightly behind);
   - there should only be one set of distinct cast shadows;

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[104] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 113-126.

- determine the closest and farthest parts of the subject in focus and set the plane of focus one-third back from the closest point (positioning the reference or identification plate on this plan will aid in focussing);
- if working on a copy stand, diffuse light sources or diffusing screens over the light sources should be used for primary lighting, with accent lighting provided by an additional source;
- highly reflective objects are best illuminated by a 'light tent' that surrounds the subject with diffuse light.

For some artworks a different type of illumination can be recommended. One example is raking illumination that can be used to stress the surface topography and texture of the artwork. Another example is polarised illumination, which is a method of normal illumination that is used to eliminate surface reflection. More details about this can be found in FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 115-118.

9.1.5. Safety for artworks and contextual documents[105]

Handling is the most likely cause of damage to an object. The concentration required by the photographic process itself can easily result in there being insufficient attention given to the object being photographed.

Always plan the photography ahead of time and before entering the photography studio. The planning should include the order in which the photographs will be taken. Pre-planning will improve efficiency, minimise unnecessary handling, and lead to an increased focus on the care of the object. Freestanding objects in particular often require extensive pre-planning. Questions to ask for are, for instance:
- which lens focal is best?
- should there be separate images of each side, or should two or three sides be recorded in a single shot?
- how should the format be orientated for the maximum image size?
- how should the object and its parts be positioned and supported?
- does it need a custom support system?
- how should the reference plate be positioned and supported?

Copy stands pose a particular risk because the photographic equipment is positioned directly above the object.

Some other, more general, recommendations are:
- never photograph when you are fatigued or rushed;
- use standardised setups for common subjects;
- use the minimum amount of equipment possible;
- place electrical wires away from frequently traversed floor space and never allow them to hang above the floor;
- standardise storage locations for photographic equipment;
- know your equipment well.

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[105] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 110.

Keep in mind that lighting is another important factor that can cause damage. See *9.1.2.4. Lighting equipment* for further information about this.

9.1.6. Workflow for the creation of the archival master file

For the creation of the archival master file we recommend that DCA partners follow the steps below:

1. One time setup:
      - Decision making for equipment, software, lighting, etc.
      - Software settings on computer.
Every time:
      - Setup camera equipment and lighting. Place object.
      - Choose target(s).

2. Image capture
      - Decide on tethered or untethered capture.
      - Check camera and/or software setting.
      - Take images.
      - Transfer images to computer.

3. Image processing
      - Process images using RAW processing software.
      - Rename images.
      - Add metadata.
      - Save RAW images in the TIFF format.

The above steps described in a more detailed way:

1. Prepare the artwork for digitisation (clean it, restore it, remove the frame, etc).

2. Decide about equipment, software, lighting, …

For further information, see *9.1.2. Digital (repro) photography equipment* and *9.1.3. Support systems and background*

3. Decide about software settings on computer.

For further information, see *9.1.2.8. Software*

4. Set up camera equipment and lighting. Place object.

For further information, see *9.1.4. Illumination*

5. Choose targets.

For further information, see *9.1.2.5. Greyscale and colour targets*

6. Decide on tethered or untethered capture

Photograph tethered to a computer, if possible. This provides more accurate image assessment to evaluate framing, focus, and expose than can be accomplished when viewing the image on the camera's small LCD screen.

7. Check camera and/or software setting

Before taking a photograph, ask yourself the following questions:
- Which capture format will I use?
- What kind of lighting am I shooting under, and what setting should I use?
- What is the lowest ISO I can use given my lighting and setup?
- How do I want to set exposure? Do I want the camera to set exposure, or do I want to set it manually?

It is recommended shooting in RAW format mode (either proprietary RAW or DNG) to obtain the highest image quality and workflow flexibility. Shooting in RAW format mode requires a greater knowledge of image processing software but allows easier white balance control and results in a better overall image quality. Proprietary RAW files can afterwards easily be converted to DNG and TIFF for archiving, or to JPEG for access with image editing software.

White balance settings adjust the camera's colour response to match the colour temperature of your lighting. Unlike photography on film, digital photography can accommodate a wide variety of illumination sources without the need for filters or changing film type. It is strongly recommended that one sets white balance on the camera before taking a photograph. The most accurate method is to record a custom or pre-set white balance on the camera. In essence, one has to fill the camera's field of view with a neutral surface, such as a grey balance card that is illuminated by the same light source as your subject. The camera automatically determines what modifications in the output of the red, green and blue sensors are necessary to produce identical RGB values for the grey balance card. This set of modifications is then applied to each subsequent picture taken, ensuring colour neutrality. It is good practice to record a new custom white balance at the beginning of each photography session in case any lighting parameters have changed. If shooting in RAW mode, one can also easily make post-capture adjustments to white balance from within the RAW processing software if a greyscale target is included within the photograph. One will have to use the White Balance eyedropper tool in the image editing software for this.

One should always use the lowest ISO (sensitivity) setting possible given the lighting conditions (between 50 and 200, depending on the camera). As one increases ISO, more noise will be apparent in the image, degrading the overall image quality. Cameras with larger sensors and larger individual pixels generally exhibit lower noise at higher ISO settings.

For a basic starting exposure, use the Manual Exposure[106] or Aperture Priority[107] mode on the camera if using the camera's meter to read the subject. The most appropriate methods in this context for a camera to read the subject are Center-weighted[108] and Spot.[109] If using a handheld meter, take a reading of an 18% grey card held adjacent and parallel to the surface of flat two-dimensional objects. For three-dimensional objects, take an incident light reading with the meter held at the subject position with the incident light diffuser pointed at the camera. Note that the camera meter can also be used for grey card readings, but this generally requires removal of the camera from the tripod and is therefore inconvenient in most working situations. The preferred method to determine final exposure is to include a neutral grey target in the image that has known RGB values. These RGB values are meant to be a general starting point for exposure adjustments. Making adjustments is best done on a good quality calibrated monitor. Making exposure adjustments on an uncalibrated monitor is not recommended. Shooting in RAW mode provides the greatest flexibility for fine-tuning the exposure.

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[106] The user selects both the aperture (f-stop) and shutter speed.
[107] The user selects the f-stop, and the camera meter determines the appropriate shutter speed.
[108] Meter reads the central area of the field view.
[109] Meter reads only a small area in the centre of the field of view.

8. Take images.

9. Transfer images to computer

10. Process images using RAW processing software.

To process the images, Adobe Camera Raw or other RAW processing software can be used, for instance. From within this software enlarge the image in the preview window to 100% and bring the greyscale into view. Click on the White Balance eyedropper tool that can be found in the tool palette, and position it over a light grey patch (for instance the N8 patch in, for instance, the X-Rite ColorChecker). This should make the patch neutral and adjust the white balance for the entire image.

If the image is too bright or too dark, one will have to adjust the exposure in the software while viewing the RGB values.

The software can also usually be used for other actions, e.g., sharpening and lens correction. Do not over-sharpen. Over-sharpening creates noticeable digital artefacts and halos around objects. View the image at 100% during the sharpening. At other magnifications the software interpolates pixels to display the image onscreen, rather than showing actual image pixels.

11. Rename images.

For further information, see *8.5. File naming*

12. Add metadata.

For further information on metadata, see *D3.1 Metadata implementation guidelines for digitised contemporary artworks* and *D3.2 Recommendation on contextualisation and interlinking digitised contemporary artworks.*

For further information on the importance of metadata for long-term preservation and the recommended metadata fields, see *D6.1 Guidelines for a long time preservation strategy for digital reproductions and metadata*.

Some metadata is already recorded automatically in an image file when it is first created in a digital camera (EXIF metadata). It includes a large amount of information about the camera, type of lens, distance from subject, exposure, focal length, and white balance settings (amongst others).

13. Save RAW images in the TIFF format.

Save the file without any further adjustments as Uncompressed Baseline IBM TIFF v6.0, with a resolution of 300 ppi and, if the resolution of the sensor of the camera allows it, then preferably a width of 4.961 pixels if vertical or 7.016 pixels if horizontal),[110] a bit depth of 24 or 48 bits/pixel[111] (8 or 16 bits per channel) for colour images and an AdobeRGB or eciRGB_v2 colour space. For greyscale images it is possible to use a bit depth of 8 of 16 bits/pixel.[112] In some cases it is worth considering digitising greyscale images as colour images, since a lot of image are not true greyscale images but also have a (colour) hue.

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[110] The width of the A2 format 4.961 pixels if vertical or 7.016 pixels if horizontal at 300 dpi. Note that this size is only recommended if the camera allows it without interpolation.
[111] Please note that increasing the bit depth from 24 to 48 bits/pixel will double the file size.
[112] Please note that increasing the bit depth from 8 to 16 bits/pixel will double the file size.

9.1.6. Workflow for a CMYK derivative file

For the creation of a CMYK derivative file with additional chromatic corrections we recommend that DCA partners follow the steps below:

1. Create a clone copy of the eciRGB or AdobeRGB archival master file (or directly from the RAW or DNG file if you kept one). This clone copy will be used for further chromatic adjustments and will become your production master file.

2. After some basic chromatic adjustments, and with the help of a calibrated screen, the first CMYK ISO12647v2 profile proof is printed with a calibrated CMYK ISO12647v2 certified contact proof printer. Please note that the use of such a printer requires regular calibration tests.[113]

3. Compare the CMYK ISO12647v2 proof print with the original, always using standard daylight 5000° K spectral continuous tubes for the correct colour perception. The use of this kind of light tubes assures that metamerism effects[114] are avoided.

4. While checking the colours, pay attention to colour cast, gradation, contrast, saturation, grey balance… The chromatic adjustments are to be applied to the whole image or to parts of it.

5. Make a second CMYK ISO12647v2 proof print of the file that has been corrected.

6. Compare the second CMYK ISO12647v2 proof print with the original.

7. If needed, make further chromatic adjustments.

8. If necessary, make a third CMYK ISO12647v2 proof print.

9. Compare the third CMYK ISO12647v2 proof print with the original.

The adjusting, printing and comparison can be repeated until the desired results are achieved.

10. Optionally crop the image to remove unwanted information (e.g., the greyscale and colour targets).

11. Save the file as Uncompressed IBM TIFF v6.0, with a resolution of 300 ppi and, if the resolution of the sensor of the camera allows it, preferably a width of 4.961 pixels if vertical or 7.016 pixels if horizontal,[115] a bit depth of 24 or 48 bits/pixel[116] (8 or 16 bits per channel) for colour images and an CMYK colour space. For greyscale images it is possible to use a bit depth of 8 of 16 bits/pixel.[117] In some cases it is worth considering digitising greyscale images as colour images, as a lot of image are not true greyscale images but also have a (colour) hue.

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[113] It is recommended to consult experts for the calibration of the printer.

[114] In colorimetry, metamerism is the matching of the apparent colour of objects with different spectral power distributions. Spectral power distribution describes the proportion of total light emitted, transmitted, or reflected by a colour sample at every visible wavelength. The term illuminant metameric failure is sometimes used to describe situations in which two material samples match when viewed under one light source but not another.

[115] 300 dpi 4.961 pixels if vertical or 7.016 pixels if horizontal, is the width of the A2 format. Note that this size is only recommended if the camera allows this without.

[116] Please note that increasing the bit depth from 24 to 48 bits/pixel will double the file size.

[117] Please note that increasing the bit depth from 8 to 16 bits/pixel will double the file size.

Be aware that
- ISO12647v2 CMYK files are not as well-suited for archiving as the eciRGB or AdobeRGB files because CMYK image are not part of Baseline TIFF (only of the TIFF extensions);
- the colour range of ISO12647v2 CMYK is smaller than that of eciRGB or AdobeRGB and thus eciRGB or AdobeRGB files with the best colour correction can never be made from a chromatic corrected ISO12647v2 CMYK file but need to be made from the RAW file or from the eciRGB or AdobeRGB archival or production master files.

9.2. Scanning and photographing film negatives and slides

Film negatives and slides can be digitised by means of a scanner. A major difficulty that might pop up while scanning film negatives and slides is that they are not always perfectly flat. This might cause focus problems. With some scanners it might be difficult for the digital image to be completely sharp if the film negative or slide is not entirely flat.

Best scanning quality is usually achieved by using a drum scanner.[118] This kind of scanner is mainly used in the printing industry and achieves a very high resolution and quality. The film negative or slide is mounted on a rotating drum for scanning. The disadvantage of the drum scanner and drum scanning services is that they are very expensive. When mounting the film negative or slide on the drum a mounting liquid is used, and some experts fear that this might have a negative effect on the long-term preservation of the original film negative or slide.

An alternative to the drum scanner is the pseudo or virtual drum scanner.[119] This type of scanner is less expensive and also achieves a very good scanning quality. The virtual drum scanner also bends the negative film or slide during the scanning process, which improves the focusing compared to flatbed scanners. Virtual drum scanners are able to scan formats from 35mm film up to 4 x 5 inch film.

The third kind of scanner is the flatbed scanner. Like the pseudo drum scanner, but unlike the drum scanner, it is a CCD scanner.[120] Also unlike the drum scanner and the virtual drum scanner it does not bend the film which can lead to focusing problems. This range of scanners includes both dedicated film scanners and flatbed scanners with transparent modules.

Recently scanners have been increasingly replaced by the use of digital cameras because of the high cost of good scans and the decreasing availability of good scanners. If scanning is not done with a high quality scanner the quality (resolution, detail and colour) of the scanned document is poor compared to the quality produced with a good digital camera. Scanners also have limitations relating to the size of the original document and surface structure.

To create digital reproductions of film negatives and slides with a digital camera one will need a reproduction stand, a macro extension tube, a small light table,[121] a non-reflective glass plate and of course a high-quality digital camera. It is important that the illumination of the light table is even and/or the camera software allows one to compensate for possible fluctuations in illumination and colour cast. Make sure that the negatives are clean and dust free, and photograph the film negatives and slides through the glass plate.

Special attention is needed for older nitrate film negatives. They tend to be very fragile and break easily. Nitrate film is also explosively inflammable and does not support heat from a light table (or scanner). It should be kept in a chemical safe or very low temperature environment at

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[118] Some well-known brands of drum scanners are ICG, Fuji, Heidelberg, Howtek and Aztek.
[119] Flextight by Hasselblad/Imacon is a well-known.type of virtual drum scanner.
[120] A CCD or charge-coupled device is a chip that transforms light into electrical charge.
[121] Preferably with a 5000° Kelvin colour temperature.

all times, and should never be handled by anyone other than an expert. It is therefore recommended that one seek the assistance of a professional specialist to reproduce nitrate film negatives.

Colour slides can be digitised in exactly the same way as negatives, but colour corrections will be necessary. Colour negatives are complicated to reproduce because it is difficult to compensate for the orange mask. Some software programmes claim it is able to do so. Instead of scanning the colour negatives it is also possible to ask a photo lab to make prints (in a format as big as possible) from the colour negative, and to subsequently digitise these prints using a digital camera.

General guidelines are listed under *9.1 Digital (reproduction) photography* also applies to the scanning and photographing of film negatives and slides. The recommended film format for the archival master file is Uncompressed Baseline IBM TIFF v6.0. It is very important to keep in mind that the digitisation of film negatives and slides in general requires a very high resolution. The reason for this is that the size of film negatives and slides is usually rather small: approximately 24 x 36mm (135 film), 6 x 6 cm (120 film), 6 x 7 cm (120 film), 6 x 9 cm (120 film), 10 x 13 cm (4 x 5 inch) or 20 x 25 cm (8 x 10 inch). This should be taken into account when one decides about the resolution. If one needs to scan, for instance, a 4 x 5 inch image so that one can make a 20 x 25 cm (equal to 8 x 10 inch) print at 300 dpi, one will need to set the scanner at 600 ppi, which yields 2.400 x 3.000 pixels. The reason for this is that 300 dpi multiplied by 8 inch (printout width) is 2.400 pixels and 2.400 pixels divided by 4 inch (original width) is 600 ppi. If one needs to scan, for instance, a 35mm image so that one can make a 20 x 25 cm (equal to 8 x 10 inch) print at 300 dpi, one will need to set the scanner at 2.400 ppi, which also yields 2.400 x 3.000 pixels. The reason for this is that 300 dpi multiplied by 8 inch (printout width) is 2.400 pixels and 2.400 pixels divided by 1 inch (original width) is 2.400 ppi.

A good professional scanner can produce a scan resolution of 8.000 ppi or even higher. The recommended bit depth is 24 or 48 bits/pixel (8 or 16 bits per channel) for colour images. For greyscale images it is possible to use a bit depth of 8 of 16 bits/pixel. In some case it is worth considering digitising greyscale images as colour images, as a lot of images are not true greyscale images but also have a (colour) hue. The recommended colour space for the archival master file is eciRGB_v2 or AdobeRGB.

9.3. Colour management

9.3.1. Introduction to colour management

Colour management plays a crucial role in the digitisation workflow, especially for still images. We all see colour slightly differently. Colours also appear to change under different lighting conditions and when different colours and tones appear next to each other. Most digital images also exist on a number of different devices during the image journey, from capture through to final delivery. At each stage the colour may be influenced by the unique behaviour of each device. Monitors display colour using red, green and blue pixels, while printed colours use cyan, magenta, yellow and black ink dots. With careful measurement and adjustment of each of the devices used in our system, it should be possible to manage the colour of the image and make colour more consistent throughout its journey.[122]

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[122] http://www.jiscdigitalmedia.ac.uk/stillimages/advice/colour-management-in-practice

Applied colour management will bring predictability[123] and consequently security into the colour workflow, from data input to conversion and output processing. Colour management systems aim at providing profiles that control how the colour is displayed or printed by devices such as cameras, scanners, monitors and printers. They aim to ensure that the printout of an image closely resembles the same image on a monitor, and the image on the monitor resembles as much as possible the original work of art or contextual document. Moreover, this process guarantees that, if the image is sent to another part of the world, where a colour-managed environment is also being used, the colours should be displayed in a similar manner.

Colour management implies the use of *calibration*, a process that consists of measuring the accuracy of each device being used within the digitisation workflow, and recording its behaviour.

The basic points in colour management are:
- monitor calibration and profiling;
- colour space settings;
- printer profiles;
- camera profiles.

One should be aware that colour management is the only way to create images that reach a high level of colour accuracy, and that allows switching from one system to another (e.g., from one monitor to another or to a printer), without losing such colour accuracy.

For more information on colour management, see
- ADF and ECI, *DIGIPIX 3 – Compendium for digital photography*, 2006, 101 p., http://www.eci.org/doku.php?id=en:downloads
- ECI, *ECI-Guidelines – Guidelines for device-independent color data processing in accordance with the ICC-standard*, 1999, 46 p., http://www.color.org/eci-guidelines.pdf
- FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 88-95.
- INTERNATIONAL COLOR CONSORTIUM, *White Paper #23: RGB Color Managed Workflow Example*, 2008, 6 p., www.color.org/icc_white_paper_23_rgb_workflow.pdf
- JAY KINGHORN, *Color Management Primer*, http://photo.net/learn/digital-photography-workflow/color-management/
- JISC DIGITAL MEDIA, *Colour management in practice*, http://www.jiscdigitalmedia.ac.uk/stillimages/advice/colour-management-in-practice

9.3.2. Monitor calibration and profiling

The first requirement for colour management is the use of a good-quality monitor. This monitor should be calibrated with a hardware measuring device, a colorimeter puck or a more expensive spectrophotometer (which is also capable of profiling printers and digital projectors). Both are bundled with the necessary software and target that will profile your monitor.

It is also possible to calibrate screens with software tools (e.g., Apple Display Calibrator Assistant and Adobe Gamma Software). However, these software tools rely on visual assessment and are not recommended. They result in a calibration that is less accurate than when using hardware devices.

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[123] FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 88.

It is important to update the monitor profiles obtained through the calibration process every eight to twelve weeks, depending on the quality of the monitor. CRT monitors require being updated more frequently than LCD monitors.

The software (that is bundled with the calibration devices) calculates the difference between the colour displayed and a reference colour. Then it establishes the correction needed to display a closer approximation of the target value. The profile is stored by the software in the appropriate location on the hard drive of the computer, and is applied automatically to the display settings within the operating system. In the case of multiple users, the administrator can create a default profile for all users.

The monitor calibration settings (targets) need to be:
- white point: 6500° K;
- gamma: 2.2;
- luminance: 120 cd/m2 (or up to 160 cd/m2 if working in a bright room) for a LCD display.

The Rochester Institute of Technology provides a practical guide about monitor calibration. For further information, see http://people.rit.edu/med2823/colormanageproject/monitors.html

9.3.3. Colour space settings[124]

All images should have an embedded colour space. The default colour space is usually sRGB. While sRGB is an appropriate colour space for viewing images distributed through the World Wide Web, it is not recommended for master files of high-quality digital reproduction. The default colour space should be switched to Adobe RGB or eciRGB. Generally, it is recommended that the same colour space be used in both the image editing software and the camera.

9.3.4. Printer profiles[125]

Printer profiles are essential if you need an image printed with accurate colour. Modern high-quality printers generally have very good profiles provided by the manufacturer that can be downloaded from the Support section of their website. These ICC[126] profiles designed for certain printer and paper combinations are based on approximation of how one's model of printer will reproduce colour on a certain paper type. Through the use of ICC colour profiles, we can convert an image between different colour spaces, without significantly changing the appearance of the image. Since the production of printed material is not part of the DCA project, we will not go into detail about the use of printing profiles.

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[124] See also section *8.2.1.3. Colour space.*

[125] For further information, see FRANZISKA FREY, DAWN HELLER, DAN KUSHEL, TIMOTHY VITALE, JEFFREY WARDA (ed.) and GAWAIN WEAVER, *The AIC Guide to Digital Photography and Conservation Documentation,* American Institute for Conservation of Historic and Artistic Works, Washington, DC, 2011 (second edition), p. 48-49 and 91-93.

[126] International Color Consortium (ICC) is the governing body for colour management standards, development and implementation. Standards-based colour management makes it easier for software and hardware developers to support colour management and for end users to use colour management effectively by setting standards that most everyone can agree upon using. The greatest contribution of the ICC is the creation of a modular, ICC-based workflow that makes it easy to prepare a single image for many different output purposes.

Yet, it should be underlined that it is important to decide whether it is the image editing software (Adobe Photoshop or other) that manages the printing or the print driver. Letting both colour manage the printing will produce poor-quality results.

In *8.2.2.3. For the derivative file(s)* we recommended the use of the ISO12647v2 profile for offset printing.

9.3.5. Camera profiles

Custom profiles can be made for digital cameras that improve the overall colour accuracy of the images and save time by reducing the number of steps for post-processing. Standard ICC camera profiles can be used to define colour and the tone curve, and they are typically assigned to processed (TIFF) images from within image editing software, such as Adobe Photoshop. Some RAW processing software of camera manufacturers supports ICC camera profiles, but they are not used in Adobe Camera Raw or Lightroom. These software programmes can alternatively use DNG camera profiles that are based on the DNG specification. Unlike ICC camera profiles, DNG camera profiles do not alter the tonal curve when applied to an image, allowing this and other RAW processing features to be more optimally controlled within Adobe Camera Raw and Lightroom.

9.4. Digital conversion of audio-visual artworks

The crucial aspect of the digital conversion of audio-visual artworks is the playback. One needs to have a high quality carrier playback in order to be able to create a high quality signal that can be digitised. This signal can be sampled, quantified and coded.

The actual digitisation process can be divided into four parts:
1. the organisational aspect;
2. adjusting the equipment;
3. the actual conversion from analogue to digital;
4. documenting the digitisation process.

To assure the correct playback of an audio-visual work, one will need the right playback equipment. The playback of old magnetic tapes and operating and configuring the playback equipment will require specific technical skills and knowledge. Only technical specialists should do such work. Especially for old technology, one will need the assistance of professional experts. A wrong connection can result in the poor playback of an audio or video signal. To know how to connect the video playback one also has to know whether the analogue material uses a component signal, a composite signal or a Y/C signal.

The equipment required for video digitisation includes:
- analogue playback equipment;
-a *Time Base Corrector* (TBC);
- possibly a colour corrector;
- a studio monitor;
- a waveform vectorscope;
- an A/D convertor (video capture board or stand alone);
- a PC;
- an external audio interface;
- software;
- hard disks;
- LTO tape deck;

- audio delay that can delay audio in multiples of video frames (needed if video-correctors are causing video delays);
- audio mixer;
- professional audio VU meter.

Since we recommend outsourcing the digitisation of audio-visual works, we will not go further into the actual digitisation of audio-visual works here. We would just like to remind that
- it is important to inspect and clean the videotapes because dust and other dirt particles can cause drop-outs;
- often the video signal on old analogue video tapes is not stable enough for contemporary video equipment – use a TBC to stabilise the video signal;
- it is important to adjust the video image prior to digitisation by using the colour bar, a TBC and a waveform vectorscope – if there is no colour bar on the tape, use a test tape to adjust the equipment prior to digitisation.
- it is important to adjust the audio prior to digitisation;
- it is best to avoid noise reduction (and other restoration techniques) during the actual conversion from analogue to digital.

9.5. Documentation

An important part of the digitisation process is documenting the actual conversion from analogue to digital. You will need to document:
- the analogue originals;
- the digitisation actions;
- the digital files.

Documenting analogue originals is part of the general conservation tasks of the collecting institution.

The documentation of the digitisation process needs to record what digitisation actions were actually carried out. For each of these actions, the following metadata should be recorded:
- the kind of digitisation action;
- the date and time of the digitisation;
- the name of the person who carried out the digitisation;
- the equipment and software used;
- the adjustments and parameters used;
- the fundamental choices and interventions.

Unlike the technical metadata required for long-term preservation, this information does not need to be recorded separately for each analogue or digital object. Such information is also usually already part of the digitisation plan or digitisation specifications.

10. Digital restoration

We will not treat digital restoration as part of this deliverable *D4.1 Digitisation workflow description for digitising the selected artworks*. Restoration is part of the general conservation tasks of a collection institution, and entails a new series of issues that need to be addressed by a specialist.

It is important to stress that in general when digitisation is for preservation purposes then digital restoration should be disconnected from the actual conversion of analogue to digital. The reasons for this are:
- one should maintain the possibility of carrying out further restoration in the future (i.e., one needs to be able to start from non-restored source material);
- the restoration should be reversible (i.e., one should be able to go back to the non-restored source material);
- the restoration should be transparent (i.e., one should be able to compare the non-restored material with the restored material);

An exception to this could be when the restoration is actually more a reconstruction than a restoration (for instance when the videotape to be digitised is in a poor condition and can only be digitised in parts that need to be assembled afterwards). Another exception could be when restoration is solely for access purposes. In this case quality improvements can be done during digitisation.

The technological evolution has made it possible for current digital technology to dissolve the difference between the original and the restored version, and between the desired result and the achieved result. At the same time these technological possibilities also imply some dangers: what happens with the historicity of the artwork if the restored version is a new or better version of the original?

This means that digitisation and digital restoration always have some ethical implications. The authenticity of an object in the collection of a heritage institution is defined by
- its context;
- its content;
- its structure;
- its appearance.
The change of one of these characteristics also has an influence on the other characteristics. It is important to remain faithful to the authenticity of the object during the digitisation and restoration.

11. Quality control

The quality control is made up of four different stages:
- step 1: check the operating system, software programmes and digital files[127] for computer viruses;
- step 2: check whether the digitisation has been carried out entirely;
- step 3: check the conformity of the digital files;
- step 4: check the integrity of the digital files.

These four checks are best performed in the above order. With some software, a number of such checks can be combined.

Step 1: check the digital files for the presence of computer viruses.
As soon as one receives the digital files it is important to check the files for computer viruses. There is always a risk of contamination, and their impact can be significant. Such a risk is especially present when one works with a subcontractor. To do computer checks one will need up-to-date anti-virus software and a computer that is disconnected from the local (internal) network (but not from the internet).

Step 2: check whether the digitisation has been carried out completely.
The next step is to check:
- whether all analogue originals have been returned (if they left the premises of the collecting institution) and whether all selected artworks have been digitised;
- whether one has received all digital files: archival master files, production master files and derivative files (if this was agreed upon);
- whether one has received all requested technical metadata.

Step 3: check the conformity of the digital files.
The third step is mainly to focus on the technical quality of the received digital files and includes checking the following elements:
- the bit integrity of the digital objects;
- the names of the folders and files;
- the file formats (and codecs) of the archival master files, the production master files and derivative files;
- the digitisation parameters (the technical specification and benchmark standards).

Step 4: check the integrity of the digital files.
The last step is a visual check (and audio check, in case of audio-visual works) of the digital files.[128] While some of the previous steps can be automatized, it is not possible for a visual check. Such verification might be time-consuming, especially for audio-visual works that in fact need to be checked from the beginning to the end. What needs to be verified is:
- are the digital files true and accurate reproductions of the original?
- do the digital files and the analogue originals have the same fidelity?
- are the digital reproductions complete?
- are the essential characteristics of the analogue originals transferred correctly?

There should be continual assessment of the quality of the process and workflow itself. We shall not go further into the quality control in this *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks* document because aspects of the quality control are also part of the *D6.1 Guidelines for a long-term preservation strategy for digital reproductions and*

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[127] Viruses do not tend to nest in data files; they need to be executed. Data files are usually not executed but only read by a programme. In some cases, e.g., Word files created with Microsoft Office, macros are saved with the data and can be executed within a programme. It is usually better to check the operating system and software programmes for viruses.
[128] For the visual check it is important that all equipment is colour calibrated to ensure that quality checks are less subjective.

metadata document.

12. Creating access copies

12.1. Image files

Once digitisation is completed, there exists:
> - a archival master file:
>   > baseline IBM TIFF v6.0,[129] eciRGB_v2 or AdobeRGB, 300 ppi, preferably with a width of 4.961 pixels if vertical or 7.016 pixels if horizontal [130] (without interpolation), without chromatic corrections
> - a production master file:
>   > baseline IBM TIFF v6.0, eciRGB_v2 (or AdobeRGB), 300 ppi preferably with a width of 4.961 pixels if vertical or 7.016 pixels if horizontal [131] (without interpolation), with chromatic corrections.

The archival file will only be used for archiving purposes and for the creation of a production master file. The production master file is a chromatic corrected version of the archival file. From this production master file different kinds of derivative copies can be created for different use purposes.
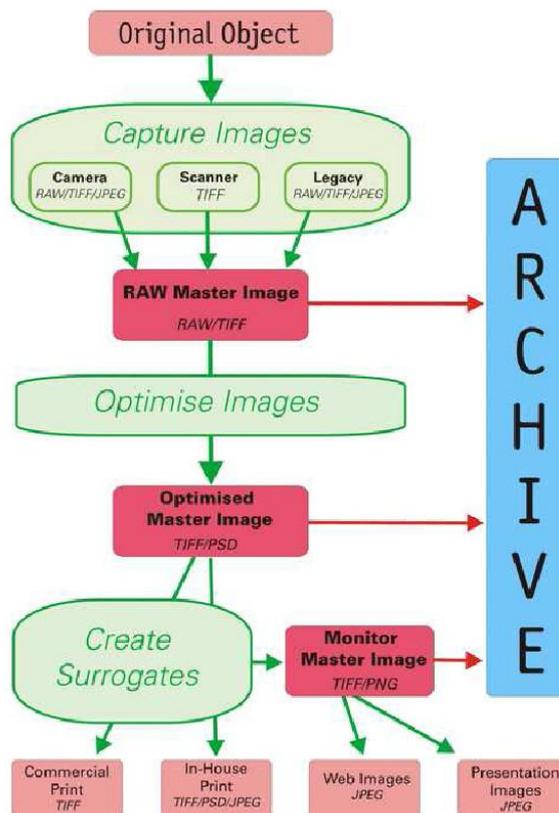
JISC Digital Media: Generic Image Digitisation Workflow (www.jiscdigitalmedia.ac.uk)

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[129] DNG is not recommended for archiving purposes. Another alternative is JPEG2000, although there also still exists some controversy about this format.
[130] The width of the A2 format is 4.961 pixels if vertical or 7.016 pixels if horizontal at 300 dpi.
[131] The width of the A2 format is 4.961 pixels if vertical or 7.016 pixels if horizontal at 300 dpi.
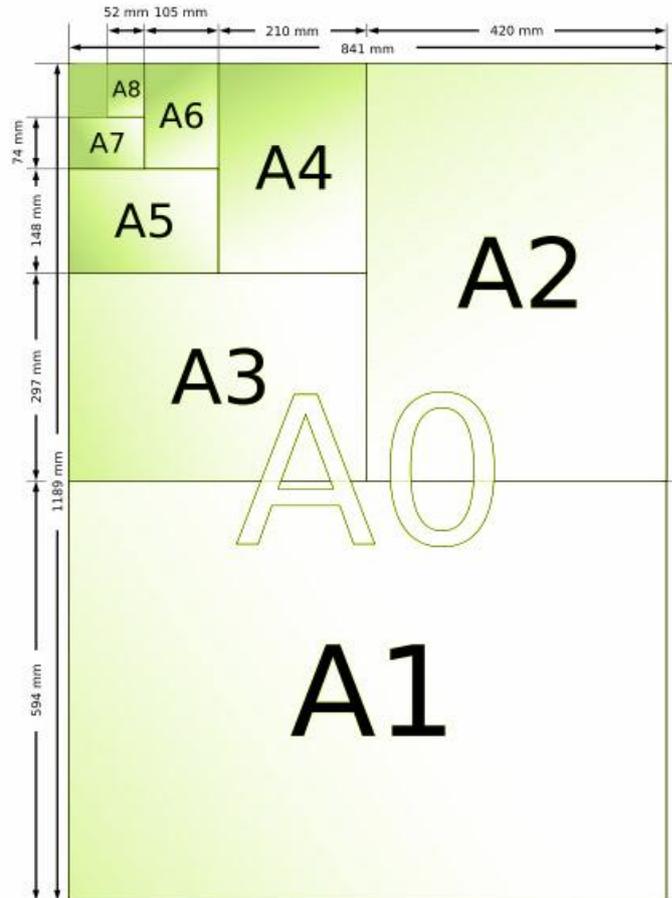
The eciRGB or AdobeRGB production master file can be converted into
- JPEG, sRGB or AppleRGB, 300 ppi with a width of 1.748 pixels if vertical and 2.480 pixels if horizontal:[132] for internal (intranet) use (e.g., in the framework of scientific research);
- JPEG, sRGB or AppleRGB, 72 ppi with a minimum width of 298 pixels if vertical and 421 pixels if horizontal:[133] for web publishing.
- JPEG, sRGB or Apple RGB, 72 ppi with a width of 200 pixels: for the DCA project and provision to Europeana.[134]

JPEG is a file format that allows compressed storage of photographs. More specifically, JPEG uses a form of lossy compression, which implies that there is always some kind of information and/or quality loss. JPEG is therefore not recommended as a file format for archiving but is usually considered good enough for web publishing. The main advantage of JPEG is that its compression allows for a smaller file size and so can be transported more quickly on the internet.

For web publishing it is recommended to create derived copies with a sRGB (Windows) or AppleRGB (Mac) colour profile. Both are standard colour profiles for the internet (i.e., for use on computer screens), while eciRGB_v2 and AdobeRGB are standard for printing purposes

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[132] The width of the A5 format is 1.748 pixels if vertical and 2.480 pixels if horizontal at 300 dpi. The minimum image size for monitor or projector display is at least one pixel for each pixel in the displayed image. Current WUXGA (1920 x 1200 pixels) or WXGA (1440 x 900 pixels) monitors generally work out at 100 ppi and 110 ppi respectively. An XGA monitor (1024 x 768) works out out at 85 ppi.

[133] The width of the A6 format is 298 pixels if vertical and 421 pixels if horizontal at 300 dpi.

[134] At the timing of writing, *Europeana* requests that content providers submit a thumbnail/preview with the specifications of a minimum width of 200 pixels at 72 ppi.

(other than offset printing). The colour range of computer screens and other displays is usually smaller than the colour range of digital printers.

For offset printing purposes within Europe one can create a CMYK derivative file. The specifications for such a copy are TIFF v6.0, CMYK ISO 12647-v2, 300 ppi with a width of 4.961 pixels if vertical or 7.016 pixels if horizontal (without interpolation), with chromatic corrections.[135]

Colour management plays a crucial role in the creation of the derivative files with different colour profiles and workspaces.

12.2. Audio-visual files

There are currently no special recommendations for derivative files. *Europeana* has no special guidelines for moving image or audio files, since the portal will not harvest them. It only harvests links to moving image files.

It is worth considering the creation of a still image of moving image files. The recommendations for these are:
  - JPEG, sRGB or AppleRGB, 72 ppi in the original size: for web publishing and other purposes;
  - JPEG, sRGB or AppleRGB, 72 ppi with a width of 200 pixels: for the DCA project and provision to *Europeana*.

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[135] For printing purposes outside Europe one can create a derivative file from the eciRGB or AdobeRGB production master file. The specifications for such are Baseline IBM TIFF v6.0, AdobeRGB (or eciRGB_v2), 300 ppi and a width of 4.961 pixels if vertical or 7.016 pixels if horizontal (without interpolation), with chromatic corrections. Eventual American or Japanese printers will then have to convert this RGB file into their local RGB standard.

13. Submitting digital files to the digital archive

The submission of digital files creates a whole new set of issues. These are not covered in this deliverable *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks,* as the relevant ones for the DCA project will be treated in *D6.1 Guidelines for a long time preservation strategy for digital reproductions and metadata* and *D6.2 Best practices for a digital storage infrastructure for long-term preservation of digital files*.

14. Making the digital files available for online access

Making the digital files available for online access creates a whole new set of issues. These are not covered in this *D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks* because some such issues, which are relevant for the DCA project, will be treated in *D5.2 Ingestion guidelines and tutorials for data mapping and aggregation*.

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ANNEX I: DIGITISATION PLAN

digitising
contemporary
art

DRAFT

DIGITISATION PLAN

Submitted by: Name + name of institution

Date of submission:

Draft version:

A. Information on Basic Conditions

Below are some points to consider before writing out your digitisation plan. Keep these in mind.

1. **Digitisation goal**

Keep in mind why you are digitising. You might digitise works
- for conservation purposes:
  ° substitution: e.g., creating a digital file to substitute the analogue video
  ° documentation: e.g., for conservation purposes; creating a digital file in order to see what the described in the collection management system looks like (by adding a digital image/audio or video excerpt) to the descriptive metadata
- for access purposes:
  ° research: e.g., creation of high resolution digital files in order to be able to zoom in on the brushstrokes of a painting
  ° own website and Europeana: to present the collection online (mostly in a lower resolution)

2. **IPR situation**

The status of IPR clearance is, in many cases, still pending or needs formal documentation. Contacting the IPR holders and/or artists might in itself be time-consuming, for instance if their addresses are not up to date. In many cases there is an optimistic stance as to clearance of IPR. However, one must consider the whole scope of possible clearances (from thumbnail to screen presentation and high-resolution print version, from still to a film strip and low res excerpt to low res full length and high-resolution full length).

With a view to future uses, negotiations will start at the widest scope and then move to the next level down if no agreement can be made. All this needs to be prepared. Different scenarios of negotiation scopes should also be considered, e.g., a possible give and take situation (high-resolution file for permission to show the lower-resolution screen version online, etc.)

- In some cases, IPR clearance is pending because of expected changes in law.
- The IPR clearance procedure might influence the scheduling of different groups of items along the timeline.
- One needs to clear IPR with one's subcontractors as well (e.g., the photographer)!

3. **Metadata situation**

Sometimes the metadata situation is not optimal:
- no (online) metadata available (newly acquired items not yet recorded, measured etc. metadata only on paper);
- incomplete metadata (incomplete mandatory fields, new mandatory fields added after recording of item, no additional important metadata entered although existent);
- new fields to be added for enrichment or enhancement of the whole system (e.g., related to IPR issues, technical specifications).

In most cases metadata entries will entail personnel time and in some cases perhaps even costs other than staff costs (e.g., outsourced maintenance). Keep in mind the work to be done relating to entering metadata in your system when creating this digitisation plan.

4.   Moving the artworks

If the items to be digitised have to be moved from their current location to the place where they are to be prepared (e.g., installed) and digitised, different aspects will determine the digitisation plan:

- time for retrieval from the current location and transport to the destination;
- transportation and packing facilities;
- insurance for transport and storage at external locations during digitisation;
- condition of storage facilities at the destination (temperature, humidity, security);
- time limits for storage might call for careful intervals of the transportation of groups of items.

5.   Analysis

Analyse the analogue works before determining the parameters for the digital reproduction (see sheets where one indicates characteristics of the items to be digitised, further in this document).

6.   Preparation of the artworks

The condition of items that are not exhibited but have been stored might not be known before they are retrieved from their current location.
Wherever known, you might be aware of the necessity of:

- cleaning;
- minor repairs;
- major repairs / restoration;
- missing parts;
- missing instructions (e.g., on how to set up a specific installation);
- time for installing the works (in case of e.g., a complex installation);
labelling the works.

7.   Digitisation: conversion to a digital format

Parts or all items will either be carried out by in-house experts or outsourced to subcontractors. Some subcontractors will work on your premises, others will use their own premises. Most subcontractors will probably use their own equipment, though there might also be scenarios where equipment is leased (by you or the subcontractor) or where you supply the equipment.
Different issues should be taken into consideration:

- nature of collaboration experience with the in-house expert and / or the subcontractor (previous experience, new staff/subcontractor, no personal, but in-house experience);
- evaluation of the scope of expertise (e.g., did you try to get the best expert for the task, have you thought of alternative avenues apart from less quality reproductions, does a subcontractor lack the equipment but could provide the expertise, etc.?);
- one needs to carry out a tender if one cannot prove a long-standing working relationship with the subcontractor. In this case a tender invitation and tender dossiers need to be prepared.

These questions might influence the scheduling of different groups of items along the timeline.
When thinking about the parameters for the digital file(s), make a distinction between the parameters for the master copy, and those for possible derived (access) copies (see sheets where one indicates characteristics of parameters for the master file and derived copies, further on in this document).

8.   Post-production & quality control

Digitisation sometimes requires postproduction (colour correction, transcoding to other formats etc.), but <u>always</u> quality control. This takes time and therefore needs to be taken into account in the digitisation plan, especially if the staff effort is to be included in the budget (staff effort after M30 is non-eligible). Test runs and quality control should also be negotiated with the subcontractors, so this in turn will entail costs.

B.   Digitisation Plan

Depending on the amount of items, the nature of the artworks, and of the basic conditions as described above – and other, more specific conditions for each individual archive and institution, the schedule below will show a number of time intervals for the different tasks and specific sets of items per interval.

In the Digitisation Plan one should specify each interval as a time segment. Please repeat this for the complete time line (M06-M28) and copy the necessary description sections below for each time segment. If not all information for segments towards the end of the digitisation phase can be provided, then explain why.

For readability, please delete from the tables following the summary below those that you do not need and that would remain empty. Keep this template doc empty in order to retrieve a table, if you delete it by mistake.

DIGITISATION SCHEDULE (example)

Months

Segments	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Segment 1

Segment 2
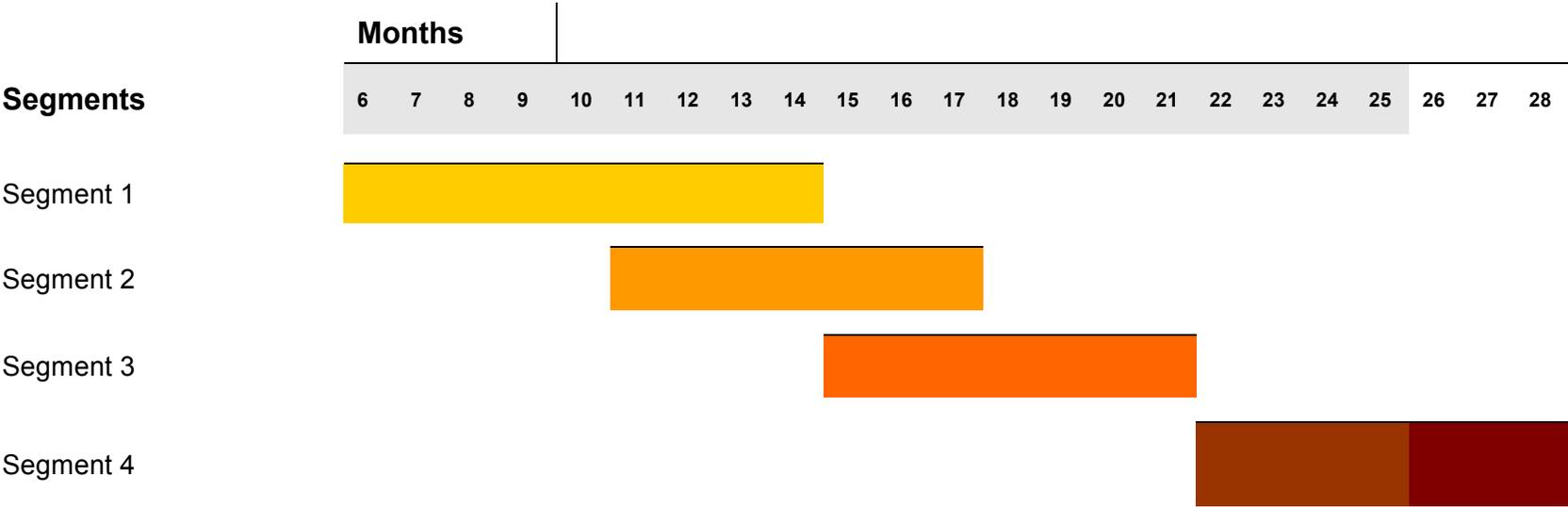
Segment 3

Segment 4

8.1 **Segment 1**

Summary:

Explain the rationale behind choosing this set of items for this particular time segment. What issues did you take into consideration? Please try to give an account of the whole situation, open issues and agreements and decisions made, i.e. all things relating to preparation, logistics. Or explain, e.g., how you plan to deal with an installation that needs to be set up. Consider this to be your checklist.

Start: Month XX

End: Month XX

Total number of works of art: XX

Reason for grouping these items: (e.g. they are all paintings and should be digitised according to the same procedure; a set of items that is going to the same out-house subcontractor; a set of items for which digitisation should be in digital video files, …)

Detailed list of individual items available: yes   no

If yes: provide the list for each section in the annex

If not: explain why

Total number of digital master copies to be produced: XX

Total number of derived copies to be produced: XX

Present location of works: XX

Digitisation location of the works: XX

Digitisation outsourced: yes   no

NOTE: Repeat this overview for each segment you create.

NOTE: for an installation work that contains audio- and/or video, describe the installation in general under 'non-AV works'. Additionally, in a case for which the video component from the installation needs to be digitised as well, describe this video in the 'AV' section of the tables that follow. In the column 'remarks' provide information so that it is clear that a certain video is part of a 'bigger' work.

Characteristics of Items to be digitised (non audio-visual material): analogue

Segment	Amounts	Type	Original carrier specifications	Condition	Type of digital file	Remarks
1	**10**	paintings	Oil on canvas	OK	Image file	N/A
2	**xx**	xx	…			

Please see 'Annex II Explanation of fields used in the tables' for

- the meaning of the fields in grey;

- examples of field values (how to complete).

This example in yellow shows how, for each 'segment' that you have identified in your timeline, the information about the concerned works can be recorded.

Characteristics of Items to be digitised (videos): ANALOGUE

Segment	Amounts	Carrier type & format	Colour system	Soundtrack	Quality analysis	Age	Duration	Condition	Type of digital file	Remarks (e.g., action to be taken)

Characteristics of Items to be digitised (audio recordings): ANALOGUE

Segment	Amounts	Carrier type & format	Stereo / mono	No. of channels	Tape speed	Duration	Quality analysis	Age	Condition	Type of digital file	Remarks (e.g., action to be taken)

Characteristics of Items to be digitised (film): ANALOGUE

Segment	Amounts	Format	Negative / positive	Colour	Soundtrack	Duration	Frame rate	Quality analysis	Age	Condition	Type of digital file	Remarks (e.g., action to be taken)

Overview of technical specification for the master copies (<u>image files</u>): DIGITAL

Segment	Amounts	Type	Resolution	Uncompressed / compressed	Bit depth	Dynamic range	Colour profile	Work space / work profile	Colour target	File Format	File name	Treatment of special cases: e.g., blank page or large formats

Overview of technical specification for the derived copies (<u>image files</u>): DIGITAL

Segment	Amounts	Type	Resolution	Uncompressed / compressed	Bit depth	Dynamic range	Colour profile	Work space / work profile	Colour target	File format	File name	Treatment of special cases: e.g., blank page or large formats

Overview of technical specification for the master copies (<u>video files</u>): DIGITAL

Video component

Segment	Amounts	Wrapper format	Codec	PAL / SECAM / NTSC	Uncompressed/ compressed	Bit depth	Frame size horizontal	Frame size vertical	Frame rate	Frame type	Field order	Frame aspect ratio	Pixel aspect ratio	Colour space	Chroma sub sampling	File name

Audio component

Segment	Amounts	Wrapper format	Codec	Uncompressed / compressed	Sample rate	Bit depth	Number of channels	File name

Overview of technical specification for the derived copies (<u>video files</u>): DIGITAL

Video component

Segment	Amounts	Wrapper format	Codec	PAL / SECAM / NTSC	Uncompressed / compressed	Bit depth	Frame size horizontal	Frame size vertical	Frame rate	Frame type	Field order	Frame aspect ratio	Pixel aspect ratio	Colour space	Chroma sub sampling	File name

Audio component

Segment	Amounts	Wrapper format	Codec	Uncompressed / compressed	Sample rate	Bit depth	Number of channels	File name

Overview of technical specification for the master copies (audio files): DIGITAL

Segment	Amounts	Wrapper format	Codec	Uncompressed / compressed	Sample rate	Bit depth	Number of channels	File name

Overview of technical specification for the derived copies (audio files): DIGITAL

Segment	Amounts	Wrapper format	Codec	Uncompressed / compressed	Sample rate	Bit depth	Number of channels	File name

Overview of technical specification for the master copies (text files): DIGITAL

When producing digital text files, you will first have to make a digital image file or your object. This will then have to be transferred to text using OCR (Optical Character Recognition) tools. You have to determine a character set and a structure for your text.

Segment	Amounts	Character set	Structure

ANNEX A

Tools (descriptions / photographs) to identify **VIDEO** formats:
- *Videotape Identification and Assessment Guide* (Texas Commission on the Arts), see: http://www.arts.state.tx.us/video/
- *The Little Reference Guide for Small Video Collections* (Barry Van der Sluis - The Little Archives of the World), see: http://www.little-archives.net/guide/
- *Video Format Identification Guide* (Sarah Stauderman & Paul Messier - Video Preservation Website), see: http://videopreservation.stanford.edu/vid_id/index.htm
- *Memoriav – Préserver le patrimoine audiovisuel / Memoriav – Audiovisuelle Kulturguterhalten*, see: http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_video_fr.pdf or http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_video_de.pdf

Tools (descriptions / photographs) to identify **FILM** formats:
- *Film Identification, Film Preservation Handbook* (National Film and Sound Archive), see: http://www.nfsa.gov.au/preservation/film_handbook/film_identification.html
- *Film Gauge Identification, Moving Image Collections: Guidance Notes* (Film Archive Forum), see: http://bufvc.ac.uk/faf/guidancenotes.pdf

Tools (descriptions / photographs) to identify **AUDIO** formats:
- *Sound carriers* (Swiss national Sound Archives), see: http://www.fonoteca.ch/yellow/soundCarriers_en.htm
- *Memoriav – Préserver le patrimoine audiovisuel / Memoriav – Audiovisuelle Kulturguterhalten*, see: http://en.memoriav.ch/dokument/Empfehlungen/recommandations_son_fr.pdf http://en.memoriav.ch/dokument/Empfehlungen/empfehlungen_ton_de.pdf

Examples of Inspection Reports

> magnetic tape

Basic Condition Report (IMAP Preservation Guide)

http://resourceguide.eai.org/preservation/singlechannel/pdf/videotape_inspection_form.pdf

> film

Print Condition Report (National Film Preservation Foundation)

http://www.filmpreservation.org/userfiles/image/PDFs/pcr_blank.pdf

ANNEX II: EXPLANATION OF FIELDS USED IN THE TABLES

Characteristics of items to be digitised (non AV-material): ANALOGUE

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (segment 1, 2, 3, …)

- Amount: indicate the amount of works concerned.

- Type: You need to attach a detailed item list derived from your content list – grouped by segments. For this purpose, group the items here that share characteristics, e.g., 10 paintings, 1 installation, 3 slides, …

- Original carrier specifications: Describe the specifications of the original work. Pay extra attention to difficult/complex works, e.g., installation, and analogue or obsolete technical carriers, e.g., Betacam SP, VHS. Otherwise you can make it very general, like paper, or colour on panel, Glass cabinet with 12 ceramic pieces in it, etc.

- Condition: Indicate e.g., whether or not the original work is damaged at the moment the list is completed. This is helpful both for you and the subcontractor; if works are sent off to be digitised out of your sight, you have some 'proof' that you sent it out in good condition (in case it comes back damaged). E.g. in an installation: "One of the side panels (glass) is scratched".

- Type of digital file: indicate here whether you want the digitised file to be an
        - audio file
        - video file
        - image file
        - text file
        - 3D file
Sometimes one analogue type (video) can result in multiple digital types (e.g., digital video + stills made of it; this will result in 'video file + image file').

- Remarks: e.g., first analogue photos are taken, and are then scanned.

Characteristics of items to be digitised (videos): ANALOGUE

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (segment 1, 2, 3, …).

- Amount: indicate the amount of works concerned.

- Carrier type & format: For this purpose, group the items here that share characteristics, e.g., 10 DVCAM, 65 U-Matics, etc. See annex I for tools to identify video carrier types and format.

- Colour system: choose between PAL, NTSC or SECAM.

- Soundtrack: Indicate whether the work is sound or silent. Also indicate whether the sound is stereo/mono, the number of channels that are used and identify these channels.

- Duration: indicate the duration of the work.

- Quality analysis: Indicate the status of the analysis: done in-house | by a subcontractor | to be done by a subcontractor – and indicate the result if analysis was done.

- Age: Time span if you have a group of items, e.g., 10-15 yrs.

- Condition: Indicate e.g., whether or not the original work is damaged at the moment the list is completed. This is helpful both for you and the subcontractor; if works are sent off to be digitised out of your sight, you have some 'proof' that you sent it out in good condition (in case it comes back damaged).

- Type of digital file: indicate here whether you want the digitised file to be an
      - audio file
      - video file
      - image file
      - text file
      - 3D file
Sometimes one analogue type (video) can result in multiple digital types (e.g., digital video + stills made of it; this will result in 'video file + image file').

- Remarks (e.g., actions to be taken): e.g.,"Physical condition to be checked with lab before any other action/handling" See Annex A for inspection report examples.

Characteristics of items to be digitised (audio files): ANALOGUE

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (segment 1, 2, 3, …).

- Amount: no explanation

- Carrier type & format: For this purpose, group the items here that share characteristics, e.g., 10 Philips audio cassette C-90, 1 TDK mini-cassette, etc. See annex I for tools to identify video carrier types and format.

- Stereo/mono: Choose between the two and identify the channels in use.

- Number of channels: Indicate the number of audio channels in use.

- Tape speed: indicate here the speed at which your audio tape runs, like for instance 4,76 cm/s.

- Duration: indicate the duration of the work.

- Quality analysis: Indicate the status of the analysis: done in-house | by a subcontractor | to be done by a subcontractor – and indicate the result if analysis was done.

- Age: Time span if you have a group of items, e.g., 10-15 yrs.

- Condition: Indicate e.g., whether or not the original work is damaged at the moment the list was completed. This is helpful both for you and the subcontractor; if works are sent off to be digitised out of your sight, you have some 'proof' that you sent it out in good condition (in case it comes back damaged).

- Type of digital file: indicate here whether you want the digitised file to be an
      - audio file
      - video file
      - image file
      - text file
      - 3D file
Sometimes one analogue type (video) can result in multiple digital types (e.g., digital video + stills made of it; this will result in 'video file + image file').

- Remarks (e.g., actions to be taken): See annex A for inspection report examples.

Characteristics of items to be digitised (film): ANALOGUE

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (Segment 1, 2, 3, …).

- Amount: no explanation

- Carrier type & format: For this purpose, group the items here that share characteristics, e.g., 10 open reel films. See annex I for tools to identify film types.

- Negative / positive: Choose between the two.

- Colour: Choose between colour or black&white.

- Soundtrack: Indicate whether the work is sound or silent. Also indicate whether the sound is stereo/mono, identify the number of channels and indicate which channels are being used.

- Duration: indicate here the duration of the work.

- Frame rate: Indicates the number of frames per second. Usually 24f/s.

- Quality analysis: Indicate the status of the analysis: done in-house | by a subcontractor | to be done by a subcontractor – and indicate the result if analysis was done.

- Age: Time span if you have a group of items, e.g., 10-15 yrs.

- Condition: Indicate e.g., whether or not the original work is damaged at the moment the list is completed. This is helpful both for you and the subcontractor; if works are sent off to be digitised out of your sight, you have some 'proof' that you sent it out in good condition (in case it comes back damaged).

- Type of digital file: indicate here whether you want the digitised file to be an
        - audio file
        - video file
        - image file
        - text file
        - 3D file
Sometimes one analogue type (film) can result in multiple digital types (e.g., digital video + stills made of it; this will result in 'video file + image file').

- Remarks (e.g., actions to be taken): See Annex A for inspection report examples.

Overview of technical specification for the master copies (image files): DIGITAL

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (Segment 1, 2, 3, …).

- Amount: no explanation

- Type: You need to attach a detailed item list derived from your content list – grouped by segments. For this purpose, group the items here that share characteristics, e.g., 10 paintings, works on paper, slides, …

- Resolution: Resolution is the number of image elements or pixels that comprise a digital image. The resolution of a digital image is expressed in pixels per inch (ppi), e.g., 300 ppi, 1200 ppi, …

- Bit depth: The bit depth determines how accurate the values of the pixels will be in relation to the original. The more bits available, the more precise the intensity of the light and colour can be in relation to the original. E.g., 8-bit (greyscale), 24-bit (colour)

- Dynamic range: If needed, indicate here that material with a large dynamic range should be scanned with the appropriate equipment; i.e., with sufficient bit depth at a sufficient dynamic range. The dynamic range indicates the difference between the strongest and weakest light intensity that a scanner or camera can observe. Details of an image that fall outside the dynamic range of the equipment used can be lost in a scan. For classic photographs on paper, a decent flatbed scanner provides in general enough bit depth and dynamic range (8bits/channel = 24 bits/dynamic range). When digitising slides, the dynamic range is more important since providing them of enough light demands special equipment (special film scanners).

- Colour profile: Colour profiles lead to the necessary colour conversions between the different equipment used. On the condition that the equipment is correctly calibrated and finetuned, the colours of the same image can look the same on different machines. A colour target contains a standardised colour palette and helps the input equipment (e.g., scanner) so that the colours of the digital image are presented correctly. Based on such a colour target, a colour profile is set. Make sure that the person doing the digitisation calibrates his/her equipment correctly, and works with colour profiles that will provide enough of a result, for example standardised ICC-profiles (International Color Consortium). These are standardised targets for the creation of ICC-profiles:
    - IT8.7/2 ISO 12641:1997 Graphic Technology—Color Reflection Target for Input Scanner -Calibration;
    - IT8.7/1 ISO 12641:1997 Graphic Technology—Color Transmission Target for Input Scanner Calibration

- Colour card: A colour card is used as a reference for the digitised documents. The scan of such a colour card should be added to the series of digital master copies and be preserved together. Two standardised colour cards often used for the creation of reference scans:
    - X-Rite/GretagMacBeth Colorchecker Classic;
    - X-Rite/GretagMacBeth Colorchecker Digital SG

- File format: Specify the file format in which the master copies should be preserved. When choosing the appropriate file format, the objectives of your digitisation play a big role. Also keep in mind the way you would like to use the master copy in the future. (For information about the different formats, see the digitisation workflow by WP4).

- File name: Indicate here the way filenames should be constructed. Also indicate whether the files need to be grouped, for example in folders. Also indicate how the folder name should be constructed. You can use meaningful or non-meaningful names. E.g., 'collection name/year of entry into database#inventory number', or '10026_s_continuous number that starts from 850 and up'.

- Treatment of special cases (e.g., blank page or large formats):
    - Indicate whether blank pages should be scanned or not (e.g., forms that have not been filled in/completed).
    - Indicate how large formats should be digitised (e.g., posters, maps, etc.). If you do it on scale 1:1, you need a scanner that's big enough. If not available:
    - The different parts are assembled together after scanning, using software (like Adobe Photoshop). This is called image stitching.
    - The different parts are stored as multiple pages in one file and the different parts are also stored as separate files:
        ° Uncompressed Baseline IBM TIFF v6.0 (Multipage): TIFF supports the storage of multiple images in one file. Keep in mind that a TIFF file can only reach the maximum of a 4GB file size.
        ° XML: Encapsulation of different TIFF files together with their metadata, all in XML.
        ° PDF/A: A subset of Adobe PDF. PDF/A is appropriate for the long term preservation of page-based documents.

- Work space: A standardised work profile is important for the correct interpretation of the colours of an image on different output equipment (printer, monitor). Printers and monitors use different colour models (CMYK and RGB). In image processing programmes like Adobe Photoshop or

GIMP, the work profile (sometimes called work space) is set explicitly. Make sure that the following option is being used:
- sRGB IEC 61966-2-1:1999 (standard independent of equipment)
- ProPhoto RGB colour space (ROMM RGB): only meaningful for originals with a high dynamic reach (for examples slides) and where the result has to be of extremely high quality (48 bit scan).

It is best to use eciRGB. This is a minimum standard, but is not supported by all software. You could also use AdobeRGB, but be aware that this is a proprietary system.

- Format derived copy + compression: The choice of the format is free. Do choose one that is good, accessible and benefits from a broad support. Example: JPEG, PDF, PDF/A, PNG 1.2, GIF (only for logos or graphs). Indicate the desired compression in relation to the master copy. JPEG compression is lossy (= with loss of information). Keep in mind that a compression ratio that is too high can cause a visible loss in terms of the quality of the image. When using compression, also indicate the data rate (= amount of compression) that was used.

Overview of technical specification for the master copies (video files): DIGITAL

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (Segment 1, 2, 3, ….)

- Amounts: no explanation

- Wrapper format: A digital video file consists of a 'wrapper' and a 'codec'. The wrapper can be thought of as an envelope which contains elements such as video, audio and metadata. The video portion of this data is usually encoded by a specific 'codec' (COmpression-DECompression algorithm). Common wrapper file formats are .avi (Audio Video Interleave), .wmv (Windows Media Video) or QuickTime (.mov) while common codecs include MPEG-4 ASP and Sorenson. See the workflow by WP4 for a set of formats for digital video.

- Codec: A digital video file consists of a 'wrapper' and a 'codec'. The wrapper can be thought of as an envelope which contains elements such as video, audio and metadata. The video portion of this data is usually encoded by a specific 'codec' (COmpression-DECompression algorithm). Common wrapper file formats are .avi (Audio Video Interleave), .wmv (Windows Media Video) or QuickTime (.mov), while common codecs include MPEG-4 ASP and Sorenson.

- PAL/SECAM/NTSC: Indicate one of these three.

- Compression: choose between compressed or uncompressed.

- Bit depth: Bit depth indicates the number of bits used to represent the colour of a single pixel in a digital image or video frame, e.g. 8 bits, 10 bits, etc.

- Frame size: Indicates the height and width of the video window according to the number of pixels. Higher resolutions produce an equivalent increase in file size and require a greater amount of bandwidth to download: e.g., 720 x 576 is standard in PAL.

- Frame rate: Indicates the number of frames per second. In PAL this is standard 25/s; for NTSC this is 30/s.

- Frame type: Choose between 'interlacing' and 'progressive scanning'.

- Field order: This indicates which field is shown first in case of interlacing. The fields are called 'upper' or 'top' field (contains the upper/first line of the image raster) and 'lower' or 'bottom' field (contains the lower/second line of the image raster). If the upper field is shown before the lower one, the field order is said to be 'upper field first' (vice versa for 'lower field first'). In cases in which the image fields are shown in the wrong order, the generated image will look shaky.

- Frame aspect ratio: The aspect ratio of an image is the ratio of the width of the image to its height, expressed as two numbers separated by a colon. In frame dimensions e.g., 16:9.

- Pixel aspect ratio: the convention to indicate the 'pixel aspect ratio' is height:width (or y/x). This is the opposite of indicating the frame aspect ration, which is width:height (or x/y). In the field of video, the pixels are not square (1:1) but rectangular. In PAL for example, a standard image (frame aspect ratio 4:3) will have a pixel ratio of 59:54 and a widescreen image (frame aspect ratio 16:9) a pixel aspect ratio of 118:81.

- Colour space: the colour space is an abstract mathematical model describing the way colours can be represented. YIQ was formerly used in NTSC (North America, Japan and elsewhere) television broadcasts for historical reasons. This system stores a luminance value with two chrominance values, corresponding approximately to the amounts of blue and red in the colour. It is similar to the YUV scheme used in most video capture systems and in PAL (Australia, Europe, except France, which uses SECAM) television, except that the YIQ colour space is rotated 33° with respect to the YUV colour space. The YDbDr scheme used by SECAM television is rotated in another way. YPbPr is a scaled version of YUV. It is most commonly seen in its digital form, YCbCr, used widely in video and image compression schemes such as MPEG and JPEG. xvYCC is a new international digital video colour space standard published by the IEC (IEC 61966-2-4).

- Chroma sub sampling: This is the practice of encoding images by implementing less resolution for chromaminance information than for luminance information, taking advantage of the human visual system's lower acuity for colour differences than for luminance. The 4:2:2 Y'CbCr scheme requires two-thirds the bandwidth of (4:4:4) R'G'B'. Examples: 4:4:4, 4:2:1, 4:1:1, 4:2:0, 4:1:0, 3:1:1, etc.

- File name: Indicate here the way filenames should be constructed. Also indicate whether the files need to be grouped, for example in folders. Also indicate how the folder name should be constructed. You can use meaningful or non-meaningful names. E.g. 'collection name/year of entry into database#inventory number', or '10026_s_continuous number that starts from 850 and up'.

A number of the parameters that have been mentioned in this paragraph are linked together. If for instance one has a video in PAL with standard image, the following settings will apply:
   - the horizontal frame size will be 720 pixels;
   - the vertical frame size will be 576 pixels;
   - the frame rate will be 25 images/second;
   - the frame aspect ratio will be 4:3;
   - the pixel aspect ratio will be 59:54;
   - the colour space will be YCrCb.

For specifications of the audio component, see below (9.1.10).

Overview of technical specifications for the master copies (audio files): DIGITAL

- Segment: indicate here which segment in the timeline ('Digitisation Schedule') this group of objects refers to (e.g. Segment 1, 2, 3, etc.).

- Amount: no explanation

- Wrapper format: It is important to distinguish between codecs and wrapper (or container) formats when working with digital audio files. Put simply, 'codec' refers to the algorithm used to encode and decode the audio data in binary form; 'wrapper' describes the container format for this raw data, which may include headers to describe encoding settings, as well as other content - such as artwork or even video data (with certain wrappers) - and descriptive metadata. Different types of wrapper will be denoted by different file extensions, such as .wav, .aiff, .mp3 etc. See Workflow by WP4 for a set of suggested formats.

- Codec: The most common codec used in digital audio is Linear Pulse Code Modulation (LPCM), which is 'lossless', i.e. all the data from the sample points is kept intact.

- Compression: choose between compressed or uncompressed.

- Sample rate: The sample rate defines the number of samples per unit of time. A well-known unit for the sample rate is 'hertz'.

- Bit depth: This indicates the number of bits of information recorded for each sample in the audio. A set of digital audio samples contains data that, when converted into an analogue signal, provides the necessary information to reproduce the sound wave. Bit depth corresponds to the resolution of each sample in a complete set of digital audio data.

- Number of channels: Indicate the number of channels.

- File name: Indicate here the way filenames should be constructed. Also indicate whether the files need to be grouped, for example in folders. Also indicate how the folder name should be constructed. You can use meaningful or non-meaningful names.

Overview of technical specification for the master copies (text files): DIGITAL

When producing digital text files, you will first have to make a digital image file or your object. This will then have to be transferred to text using OCR (Optical Character Recognition) tools. You have to determine a character set and a structure for your text.

- Character set: e.g., Unicode based, UTF-8

- Structure: e.g., XML scheme

Source: Jisc Digital Media guide, http://www.jiscdigitalmedia.ac.uk/

ANNEX III: FEEDBACK TO *D4.1 DIGITISATION WORKFLOW DESCRIPTION FOR DIGITISING THE SELECTED ARTWORKS*

(Pierre-Yves Desaive, Lies Van de Cappelle, July 2012)

List of institutions participating in the survey, with contact person

- LISTASAFN (Dagný Heiðdal): dagny@listasafn.is

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- FRISSIRAS (Artemis Stamatelou): artemis.stamatelou@gmail.com

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- SERRALVES

- EPMAS

- MBVB

1. Introduction

2. Determining digitisation goals

p.8 : would you add goals to the list ? If so, what are they ?

LISTASAFN: No
FRISSIRAS: The list is complete. I'd only add in the first goal of preservation, the aspect of *protection* or *safeguarding* of the original art collections, given the fact that through digitisation the museum enhances the documentation of the artwork by creating enriched metadata about the content, provenance and status of the artwork. More information about the artwork means better protection of it.
EPMAS: The general goals for a digitisation project are covered exhaustively on the list. We would nevertheless like to add an additional remark under the "access" goal: Regarding the "not exhibited permanently" items, this is especially true in the case of tissues or works/documents on paper (prints and drawings/pieces of archive like letters, journal extracts, photographs, etc.), considered amongst the most fragile in terms of risk of environmental deterioration. Another danger, run especially by the pieces of archive, comprises possible damages and acts of destruction caused by users who, instead of copying a text, choose to tear a whole page, or part of it, off !!! As stated on page 9, this would rather be a "preservation" goal.

p. 9 : the "Scan Once for All Purposes" principle ("artworks that…"): would you add elements to the list? If yso, what are they?

LISTASAFN: Yes. artworks that are extensive or complex to install
FRISSIRAS: Artworks that share the same or similar features (i.e. of the same type, size, technique etc.)

NIMK: artworks that needs derivatives in different formats; artworks that needs derivatives on rapidly changing platforms (and thus need other formats)
EPMAS: The *Digitise Once for All Purposes* principle is also especially recommended for the digitisation of artworks that are kept away from the main premises of the Museum and for artworks that are pn long-term loan to distant institutions.
MBVB: Additions: Objects that are not stored in-house; very complex objects

3. Creating a project plan

3.1. Estimating the costs and duration of the digitisation project

p.11: can you think of more reasons that make it difficult to estimate the cost and duration of the preparation stage? If so, what are they?

TRANSMEDIALE: Copyright costs (not only time to secure them, but also budget to pay some recompense) should be considered. Obsolete formats (e.g., CD-Roms) may require more complex restoration before being archived. Meta-tagging and descriptions: especially large collections will require a lot of new descriptive content, budget and personnel for this, which should be considered.
MMCA: Sometimes the condition of the artwork might create problems and change the estimated cost due to damages that were not foreseen before digitisation. For example, the work was stored in excellent conditions (and that its state on the database) but due to its vulnerable materials the artwork demands restoration that was not previously calculated and that as a fact changes the cost.
FRISSIRAS: I'd' add the *location* of the collections, as an aspect in the *condition* factor of the preparation stage. Moving art works and the related transportation tasks may affect the time schedule and the cost.
NIMK: estimating cost and duration of the actual conversion: hardware and price of hardware changes rapidly, so hard to estimate cost and duration two years in advance.
EPMAS: In our experience, the most important reason why it's difficult to estimate the cost and the duration of the preparation stage is the condition of the artworks, when special restoration treatment is required. Another factor interfering with the duration of the process is the need for a museum to temporarily interrupt the digitisation because of other current needs of an urgent character, such as the preparation of a number of artefacts for external loaning or for a last-moment decided temporary exhibition.
MBVB: Other unforeseen circumstances, e.g., change in subcontractor(s).

3.2. Writing a digitisation plan

p. 11-12: would you add elements to the list? If so, what are they?
LISTASAFN: No
FRISSIRAS: No, in my opinion, the list is complete.
NIMK: explaining the decision procedure/criteria for choosing the objects to be digitised
EPMAS: We think that the list of the elements cited is complete.

3.2. Deciding between in-house digitisation and outsourcing

p. 12-13: does this description meet your own experience with outsourcing? If not, what would you add to it?

LISTASAFN: It takes time to find out if works should be digitised in-house or if they should be outsourced but the Grant Agreement was signed before we could take that decision in a

well informed way. Fortunately we came to the same decision as we indicated in the Grant Agreement.
MMCA: Yes, the description is adequate and meets our own experience.
Frissiras: Yes, it meets the experience of the Frissiras Museum regarding this issue. I'd only add *"available budget"* as another factor of deciding between in-house and outsourcing.
EPMAS: We would like to add, as factors that determine this choice, the dispersion of the material in different places, often at a long distance from the museum's main premises, as well as the complexity of some artworks composed of different parts that need to be assembled, such as large-scale sculptures or installations, which need the intervention of highly specialised work-teams either for their displacement and convenient setting or for the taking of the digital pictures itself.
MBVB: *Addition: the size / complexity of objects*

p. 14: do the recommendations seem relevant to you and/or would add elements to the list? If so, what are they?

LISTASAFN: It is very relevant, nothing to add.
MMCA: These recommendations also seem to be adequate and cover the whole process.
FRISSIRAS: Yes, I think these apply to our case too
NIMK: recommendations seem relevant
EPMAS: We have no other elements to add.

4. Defining the selection

p. 16-17: do the selection criteria seem relevant to you and/or would you add elements to the list? If so, what are they?

LISTASAFN: Nothing to add
TRANSMEDIALE: Once a work is selected, in general according to the criteria in the D4.1 document, it is backed-up and restore as far as possible, regardless of the "achievable quality" of the digitisation. Many of our old works are of very poor resolution, but are still valuable.
FRISSIRAS: Yes, I think these criteria apply to our case too.
NIMK: selection criteria seem relevant
EPMAS: Your list of selection criteria is already quite complete and exhaustive. You nevertheless might consider adding two more factors: (1) Factor 'place': artworks kept in appendices located at a very long distance from the museum's main premises or considered as long-term loans to other public institutions, sometimes situated in other cities. (2) Factor 'time': digitisation schedules that have to cope with the museum's long-term workflow, e.g., in case of programmed exhibitions or of a temporary closure because of extension and/or renovation works.

5. Clearing copyright

- p. 18: do the 7 steps for clearing copyright seem relevant to you and/or you add steps to the process? If so, what are they?

LISTASAFN: Nothing to add
NIMK: relevant, maybe a bit too profound
SERRALVES: The IPR issue turned out to be far more complicated than we were counting on. As Europeana added in the middle of the project questions with Creative Commons, all previous talks about it were insufficient.

p. 21: did you experiment clearing copyrights directly with artists? If so, could you give some information about it?

TRANSMEDIALE: Clearing copyright proceeds through a 'friendly letter' sent to all applicable

artists. Artists can choose specifically to what degree their work can be incorporated into our digitisation and dissemination procedures. Now subsequent to beginning the DCA programme we have integrated copyright agreements into our application materials and contracts for the festival, which will allow us to represent artists' work through Europeana, Gama or on our website.
MMCA: Yes, basically in the majority of our cases we cleared copyrights directly with the artists themselves and most of them received the whole project and the aims and objectives of Europeana.
FRISSIRAS: Copyrights have been cleared for digitisation at the beginning of the project. / see our digitisation plan positively.
EPMAS: In our case, all IPR issues were cleared prior to the beginning of the project.
SERRALVES: *No. As the latest decision was just informed I July and we are aware that it will be discussed in Ljubljana, no IPR issues were already cleared.*

6. Analysing the artworks to be digitised

6.1. Analysing the works of fine arts

p. 22: does the list of issues seem relevant to you and/or would you add issues to it? If so, what are they?

LISTASAFN: Nothing to add
MMCA: Concerning the part where it states "how many works are there within the object?" one could also mention the fact that in an installation, for example, an artist may use the movie of a cinematographer. How should such a case be interpreted?
FRISSIRAS: Yes, I think these issues seem relevant to our case too.
NIMK: n/a
EPMAS: In our case, there were no additional issues to deal with.
MBVB: Additions: How many parts does a work consist of; How to install the object?

6. 2. Analysing the audio-visual works

- p. 22-24: does the list of issues seem relevant to you and/or would you add issues to it? If so, what are they?

LISTASAFN: Nothing to add
NIMK: Are there other (better) copies of this work?
EPMAS: AV works are not included in our collection.

7. Preparing the artworks to be digitised

- p. 25: have you experienced specific problems when preparing the artworks (including audio-visual works) for digitisation? If so, what are they?

LISTASAFN: None
TRANSMEDIALE: With CD-Roms, it may be difficult to find the right operating system with the right environment to play them as they were intended. It may be difficult to evaluate works which cannot be accessed directly.
MMCA: The biggest problem was when preparing big installations in the museum. Due to lack of space we had to digitise all installations (with many parts, and some with audio visual material) in a specific time frame and that made it stressing to finish everything on time and accurately.
LCCA: Yes. While preparing audio-visual works for digitisation we realised that for works that are in VHS tapes the picture is sometimes not still. This is also related to digitising slides, the

picture is dark and over time has lost colour.
EPMAS: The digitisation for a project such as DCA can also be the occasion for the fabrication of a good quality presentation infrastructure which is needed for an artwork's convenient exposure.
MBVB: Parts in different locations; Confusion about the way to install the artwork.
SERRALVES: *Not until now.*

8. Defining the quality parameters

MMCA: Overall, this segment attempts to give a clear view of quality parameters but it should be more "simple" in explaining because in most cases addresses curators, art historians and professionals who do not understand in depth all the technical issues and consequences in every choice that they might take.

8.1. The file types

- p. 27-29: does the list of file types seem relevant to you? Does it raise questions? If so, what are they?

LISTASAFN: Nothing to add
TRANSMEDIALE: Certainly with regard to CD-Roms and some DVDs it is better to make a disk image (ISO) as the master archival file.
NIMK : seems relevant
EPMAS : The procedure is clearly presented.
MBVB : Yes and it does raise the question on how to store all these enormous .dng files, which is not really practical

8.2. The quality parameters of the image files

- p. 30-36: do the definitions of the quality parameters (resolution, bit depth, colour space and file format) seem clear to you? If they require more explanation, what would it be?

LISTASAFN: This part has always been very confusing to me and still is but it would have been of great help to get this text at the beginning of the project.
NIMK: seems clear
EPMAS: The quality parameters of the image files are presented in a clear and exhaustive manner.
SERRALVES: For photos, they were clear.

8.3. The quality parameters of the moving image files

- p. 36-39: do the definitions of the quality parameters seem clear to you? If they require more explanation, what would it be?

LISTASAFN: This part has always been very confusing to me and still is but it would have been a great help to get this text at the beginning of the project.
TRANSMEDIALE: They are very thorough, I think. h.264 should be considered as an additional standard for derivative video.
NIMK: seems clear, but there are some typo's that need to be fixed
SERRALVES: For films and video, I had to search for more information, as the ones provided were not enough.

8.4. The quality parameters of the audio files

- p. 40: do the definitions of the quality parameters seem clear to you? If they require more explanation, what would it be?

LISTASAFN: This part has always been very confusing to me and still is but it would have been a great help to get this text at the beginning of the project.
NIMK: You refer to the video parameters and they seem clear.
SERRALVES: *I had to search for more information, as the ones provided were not enough.*

9. Digitisation

- p. 41: this part is intended to be described in a more detailed way in D4.2. What is the information you would find relevant to be added?

LISTASAFN: Nothing to add
TRANSMEDIALE: It seems quite complete, only possible to add, with regard to new forms like CD-Rom, that ISO disk images can be made even when the work cannot be viewed. Some parts of the work can be retrieved from a damaged disk which still afford a sense of the work even if some data is irretrievable.
NIMK: 9.4 Additions to required equipment: audio delay that can delay audio in multiples of video frames. Needed if video-correctors are causing video delays. They typically tend to delay one frame ; audio mixer ; professional audio VU meter.
NIMK: 9.4 Reminder: if there is no colour bar, consider correcting the black level and white level with the colour corrector or TBC.
EPMAS: Regarding our case, the description of the digitisation procedure in chapter 9.1 seems complete.
MBVB: No additions, but I do want to point out that we made other decisions on the image files we collect and archive.

10. Digital restoration

- p. 47: this part is not intended to be described in a detailed way in D4.1. However, do you think more information should be added? If so, what would it be?

LISTASAFN: Nothing to add.
TRANSMEDIALE: It is quite complete.
EPMAS: Is digital restoration going to be a part of long-term sustainability? At this point, the information provided is adequate, we have nothing to add.

11. Quality control

- *(to be described in a more detailed way in D6.1)*

12. Creating access copies

- p. 49: does the description of the access copies seem relevant to you, or do you think there should be more information added? If so, what should it be?

LISTASAFN: Nothing to add.
TRANSMEDIALE: It is relevant and adequate.
EPMAS: We have nothing to add.
MBVB: *No additions, but I do want to point out that we made other decisions on the image files we collect and archive.*

13. Submitting digital files to the digital archive

- *(to be described in a more detailed way in D6.2)*

14. Making the digital files available for online access

- *(to be described in a more detailed way in D5.2)*

Feel free to add any comments or remarks you would find relevant.
Thank you for your collaboration!

ANNEX IV: GLOSSARY

Bit depth
In computing, the number of bits used to represent a discrete item, using a coding system based on numeric values. In digital imaging, the number of bits used to represent a pixel (at least 15 bits for digital video and 24 bits to produce full colour in RGB – 8 bits per colour, red, green and blue, for a total of 16.7 millions of colours; for digital prints, that use 4 colours – Cyan, Magenta, Yellow and Black –, the bit depth is 32, or 4 x 8 bits).

Born digital
Files that have been created by using a digital device, or through the use of a software. "Born digital" stands therefore as an opposite to "digitised", where an analogue object or a signal has been turned into a digital file.

Copyright
The exclusive legal right, given to an originator or an assignee to print, publish, perform, film, or record literary, artistic, or musical material, and to authorise others to do the same. A particular literary, artistic, or musical work can be covered by copyright. The copyright over a given work lasts for a period of 70 years following the death of the producer of the work. It covers the right to reproduce the work in any form, including in a database that has a public access (for instance, via the Internet).

Colour space
A device colour space describes the range of colours, or gamut, that a camera can see, a printer can print, or a monitor can display. Editing colour spaces, such as Adobe RGB or sRGB, are device-independent. They allow to edit images in a controlled, consistent manner.

Calibration
Calibration is part of colour management. It is the process that consists in measuring the accuracy of each device being used within the digitisation workflow (monitors, printers), and recording its behaviour.

Digitise
To convert (pictures or sound) into a digital form that can be processed by a computer.

Data compression
Data compression implies reducing the volume of a given file by using compression algorithms. While it usually results in a loss in quality of the reduced file, there are lossless formats – as opposed to lossy – that allow a conversion from one format to another that does not result in the loss of data or information.

Digital preservation
Digital preservation consists of maintaining in a condition that is suitable for use those files that have been produced through a digitisation process, or that are digital born. One should consider the alteration of the digital object itself (the "bit rot"), but also the technological environment in which the object was produced, with its evolution and obsolescence cycle. The Library of Congress (USA) has established the National Digital Information Infrastructure and Preservation Program, while the The Digital Preservation Coalition focuses on the preservation of digital resources in the UK.

Distribution Copies

Distribution files satisfy only limited researcher needs, and are not intended to substitute the original record if the original is damaged, destroyed, or not retained. Distribution files are retained only as long as needed to satisfy a specific distribution need. They are not actively managed over the long term. Distribution copies are generally derived from preservation master or reproduction master files. However, some classes of distribution files are direct captures from the source object and have no parent master file.

Metadata

Structured data about a physical or a digital object. The most important categories of metadata are the descriptive metadata (identification and location of the object), the structural metadata (used to describe relationships between an object's component parts), the technical metadata (information about the creation of the object), and the administrative metadata (about the management of the object).

Pixels

Stands for "picture element; any one of the dots of uniform illumination that comprise the image on a television screen or computer monitor in the aggregate. Pixels may be binary (black and white) or multi-valued to display colours or gradations of a grey scale. A pixel on a colour screen is a combination of three dots--blue, green, and red--called *subpixels*. The more pixels per inch, the better the resolution of the bitmap or screen.

Public domain

Works in the public domain are those whose intellectual property rights have expired, which means that they are unavailable for private ownership and are available for public use. These rights are country-based and vary: a work may be subject to rights in one country and not in another. Most of the time, these rights extend up to 70 years after the creator's death.

Resolution

Refers to the density of the image. It is expressed as the number of pixels (PPI, pixels per inch) for a screen image, or the number of dots (DPI, dots per inch) for a printed image. The more units, the higher the resolution and the sharper the image.

Sources:

http://www.abc-clio.com/ODLIS/odlis_c.aspx
http://www.projectcest.be/index.php/Glossarium
http://www.den.nl
http://www.archives.gov/preservation
http://www.drycreekphoto.com/Learn