3D Digitisation of Icons of European Architectural and Archaeological Heritage

3D ICONS

D2.1: Digitisation Planning Report

Authors:
P. Cignoni (CNR)
A. D'Andrea (CISA)

3D ICONS is funded by the European Commission's
ICT Policy Support Programme

cip competitiveness and innovation framework programme

Revision History

Rev.	Date	Author	Org.	Description
0.1	20/12/12	P. Cignoni	CNR	First draft
0.2	25/01/13	P. Cignoni	CNR	Final draft
0.3	29/01/13	S. Bassett	MDR	Edited draft
0.4	08/02/13	G. Guidi	POLIMI	Annotated draft
0.5	08/02/13	L. De Luca	CNRS	Edited draft
0.6	11/02/13	P. Cignoni	CNR	Edited Draft
0.7	13/02/13	S. Bassett	MDR	Final version
0.8	13/02/13	P. Cignoni	CNR	Edited Draft
0.9	30/04/13	P. Cignoni	CNR	Edited Draft
0.10	11/06/13	P. Cignoni	CNR	Modification according the reviewers comments
0.11	12/06/13	P. Cignoni	CNR	Moved Available Doc. List section, clarified monument definitions
0.12	12/06/13	P. Cignoni, S. Bassett	CNR, MDR	Included final version of section 11 and added monument list from the DB. Digitisation targets added. Final editing.
0.13	14/06/13	K. Fernie, S. Bassett	MDR	Final Review and edits.

Revision: Final

Authors:
P. Cignoni (CNR)
A. D'Andrea (CISA)

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

3D-ICONS is a project funded under the European Commission's ICT Policy Support Programme, project no. 297194.

The views and opinions expressed in this presentation are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

Contents

1 Executive Summary

Deliverable 2.1 Digitisation Planning Report is a preliminary overview of all the aspects to be taken into account in the planning of the digitisation and post-processing of the data that will ultimately be supplied as 3D Models to Europeana. An updated list of all the monuments, archaeological sites and buildings that are to be digitised, forms part of this report along with specific information about each item. Each data item is defined within the report. D2.1 also sets out the initial definitions and assumptions for these models and their original datasets that will form the basis for the work carried out by the project.

The various data acquisition methodologies are discussed as a variety of these will be used to acquire the initial data and it is important to understand the reasons certain technologies may be used in each case and the implications this can have on the resulting end products.

In the same way, post-processing methodologies are discussed as a strategy for producing rich 3D representation according to the morphological complexity of the artifact and to the final purpose (documentation of the actual state of the artifact, virtual reconstruction of hypothetical past states, visualization of temporal transformations, etc.).

The scheduling of the digitisation was originally going to be implemented through individual Digitisation Plans but with the implementation of the Progress Monitoring Tool, the data from these plans along with the updated list of monuments, entities and details along with the form of digitisation has been transferred to this tool which will provide the information for all future monitoring and progress reporting. A set of digitisation targets is provided for each partner.

Five Case Studies have been selected as illustration of the 3D-ICONS process pipeline and these are briefly described. The case studies will be developed over the next 198 months.

Finally, Table 5 provides a summary of the digitised content at this time to be provided by the 3D-ICONS partners. A full list of monuments as recorded in the Progress Monitoring Tool is provided in a separate PDF report "3D-Icons_MPT_Report-20130613.pdf".

2 Background

This report consists of:

- The updated list of monuments, site and objects to be digitised (section 11, table 5), together with the material available; details on how the granularity of the reported elements was decided is reported in section 0.
- The methodology chosen for data acquisition (section 7) and post-processing (section 8), including relevant information about metadata (section 5) and quality assurance; the scheduling of such operations including checkpoints (section 9).
- Digitisation targets for each partner (section 9).

This report has been updated to take into account feedback provided by the reviewers at the first Technical Review (April 2013) and to include relevant developments in the 3D-ICONS Project that have taken place in the intervening five months after the submission of the original report. These include the introduction of a progress monitoring tool, a more up to date list of monuments for digitisation, the case study topics selected and digitisation targets for each partner.

3 Introduction

The purpose of this document is to establish the guidelines for the compilation of the updated list of monuments (as defined by point a) below) of the ***D2.1 Digitisation planning report,*** particularly to provide a uniform interpretation of some of the basic concepts faced in the report.

To clarify the purpose of this document the relevant portion of the Description of Work (DoW) is stated here:

- "D2.1 Digitisation planning report (Month 9). The report will include a) the updated list of monuments, site and objects to be digitised, together with the material available; b) the methodology chosen for data acquisition (WP3) and post-processing (WP4), including relevant information about metadata and quality assurance; the scheduling of such operations including checkpoints. The responsible partner is CNR with the support of all partners involved in the WP."

- "3D-ICONS will both contribute to the expansion of Europeana's content base and also offer enhanced experiences for its users by bringing exciting and engaging content for archaeological monuments and historic buildings. The content will comprise of a range of formats including 3D models, movies, texts and 2D images. More than 1000 3D models of buildings, more than 4000 3D models of architectural details and related objects and more than 10.000 high-resolution images will be brought to Europeana by 3D-ICONS."

This deliverable reports the description of the result in terms of 'what' is being provided to Europeana (metadata for models, etc.), not the detail of 'how' 3D-ICONS will present the previews and the data itself to the users. This latter subject will be discussed in 'D5.1 Report on Publication Formats Suitable for Europeana' (due in M18). In particular, before starting the collection of the data and metadata, for the compilation of the updated list of monuments, site and objects to be digitised, it is important to have a common understanding of the following concepts that will be discussed in this document:

- Granularity of the data: What constitutes an entry in the list?

- Collected metadata: What data has to be provided?

- IPR: What are the property rights on the data?

4 Granularity of the data

The project will provide for Europeana published 3D models organized as a set of "***Monuments***" "***Cultural Entities***", "***Cultural Details***", and "***Models***". In the following sections, ***italic*** text will be used to specifically denote one of these terms, in order to distinguish these from the generic descriptions of 3D models.

Monuments are logical containers that are used to collect the entities that are logically connected. In some cases, a monument coincides with a single main entity with which a 3D model is associated, but in other cases it is a more abstract way of collecting entities together. E.g. a museum that holds a collection of entities.

In practice, the main difference between the two cultural categories is that the ***entities*** in general are large architectural objects (such as buildings and sites) or very important sculptural pieces and the ***details*** are smaller sub-components of specific interest (such as a carving a gargoyle, a piece of furniture, a portion of the statue of particular interest, one character of a sculptural group, etc.).

For each ***entity*** or ***detail*** there is one or more corresponding actual 3D ***models***. ***Models*** are finished 3D dataset for which the providers have completed the processing. Temporary range maps, individual scans or intermediate files are **not** to be considered ***models*** and should not be part of the assets.

Complete point clouds, assembled from multiple acquisitions, possibly with normal and color, can be considered to be ***models***. It is not mandatory that models correspond to a textured surface object, but only that they represent the final step of a specific processing pipeline.

Different level of details of the same 3D model usually cannot be considered to be separate ***models***. On the other hand, models that have been processed with different purposes can be considered different ***models***: e.g. it is acceptable that for an ***entity,*** both the full model and a model that was specifically processed for its insertion in to an interactive platform can be considered as two separate ***models.*** Different acquisition campaigns of the same CH object should be considered to be different group of ***models***.

To further clarify the concept, we can say that for 3D ICONS, a ***model*** is the combination of an actual 3D model and its metadata and paradata, i.e.: how the model was produced, serving which purpose, using which technology etc. Two models are different if they differ in any if their components, including metadata and paradata. So if a 3D model is obtained from another one with some meaningful processing (e.g. decimation) required for using it in a different context or purpose, which is documented in the new paradata, that 3D model is a different ***model***. The following are examples of different ***models***:

1. File *model.ply* having 3 million polygons, representing an old house, obtained with 3D scanning, and its metadata. Texture taken from photos. Made to document the house.

2. File *model.ply* having 3 million polygons (same as 1.), representing an old house, obtained with 3D scanning, and its metadata. Texture not as in 1. but taken from ancient paintings. Made to document how the house was 100 years ago.
3. File *model.dwg* obtained from *model.ply* using AutoCAD to re-model it, representing an old house, obtained with 3D scanning, and its metadata. Made to have a vector file for the purpose of structural restoration.
4. File *model-b.ply*, 30,000 polygons, representing the same old house, obtained from model.ply by decimation. Texture from photos. Made to display the house on a mobile phone.

This is especially important when dealing with some of the pre-existing datasets mentioned in the list of available assets in the DOW documents, like "*the historic center of city X*" or "*the Y archaeological complex*". In such cases, it is clear that the whole dataset, which is an entity per se, may (and should) also be split in sub-components, to fully exploit the available data.

There are a number of reasons for this choice:

- the global model of an architectural complex is available at a certain resolution X, while individual parts are available at a higher resolution. Adding these higher resolution components to the set will allow the user to access more detailed data.
- a single building is as famous as the architectural complex it is included in. The user may be interested in visualizing and accessing the data of this specific building/component.
- a single component/building has been acquired/modeled using a specific technology (different with respect to the entire complex), and preserving its individuality would make possible a more profitable use of the available data.

Since it is impossible to define a strict rule, based on precise measures, the rule of thumb that will be followed is that each '*self-contained*' and '*noteworthy in its own right*' building or component of an architectural complex, may be considered a separate ***entity*** for the asset database. The required level of 'independence' and 'famousness' needed to consider a single building, or a component of a larger complex, an ***entity*** its own right is delegated to each partner. The fact that a building has a dedicated page on Wikipedia could be a reasonable hint of it being a noteworthy building.

An easy-to-understand example can be found in the *Piazza della Signoria* in Florence. The 3D model of the entire square is an ***entity*** (and can be considered as the *main* entity). Famous historical buildings and architectural elements, such as the *Palazzo Vecchio*, the *Loggia dei Lanzi*, the *Biancone Fountain*, can be considered ***entities*** on their own. Other buildings of the square, even old, interesting ones, probably, fail to achieve the same level of independence and famousness, and perhaps should not be considered ***entities*** on their own but details (of the Square).

Going below this level, the statues in the *Loggia dei Lanzi* should be considered 'architectural details' and may be included in the asset dataset on their own as ***details*** However the *Biancone* statue of the fountain, given its cultural and historical importance, may be considered an ***entity*** on its own but it is a borderline case. Other statues decorating the fountain should be considered ***details***.

An entirely different case is the definition of the 'details'. Details are smaller components of the architectural complex or other objects related/contained in the complex that are of interest for the better comprehension of the whole complex.

Here the rules are more relaxed. Th main point is probably that the ***details*** are somewhat relevant for the comprehension of the whole ***entity***. Again, the decision of which components/objects/'related artifacts' may be eligible for the inclusion in the asset database is delegated to each partner. A basic idea is to include for each ***entity*** those ***details*** that may be of interest for tourists or scholars.

Clearly it does not make much sense to include as ***details*** objects that are only slightly related to the main ***entity***. Example: when providing models for Stonehenge, it is questionable to add as ***details*** a 3D reconstruction of the stone-erecting mechanism.

Adding the *entire* content of a building as ***details*** is a more delicate case. If it is relevant, like the objects in a museum or the furniture in a famous building, it should be done otherwise it could be questioned. Again the final decision of which ***details*** may be eligible for the inclusion in the asset database is delegated to each partner.

4.1 Large and Small Models

In the DoW, in section B.3.2.b. Work plan, in the *Performance monitoring table,* two rather ambiguous terms have been used: *large models* and *small models*. To have a unified interpretation of these indicators, we will refer to the largest physical dimension of the represented object and use the following classification table:

Class	Physical size
Architectures, scenes, large monuments	>50m
Smaller monuments and interiors	10m to 50 m
Statues	2m to 10m
Large artefacts	0.80m to 2m
Medium artefacts	10 cm to 80 cm
Small artefacts	2cm to 10cm
Very small artefacts	< 2cm

Table 1: 3D Model Size Classifications

This classification defined in Table 1 will be used to categorize the size of the various models produced during the project and to monitor and assess the progress of the digitisation efforts.

5 Metadata

The scope of the 3D-ICONS project is twofold:

- Making available 3D content for Europeana;
- Developing a metadata schema able to capture all the semantic information present in the digitisation process (provenance) and in understanding and interpretation of data objects (paradata).

While as far as the data-acquisition, data-capture and publication of 3D cultural object are concerned, the existing technologies allow the former scope to be easily dealt with, the latter, being innovative also for Europeana, has to be addressed with particular attention.

3D-ICONS has identified a need to capture metadata relating to the digitisation processes used and the provenance of 3D models to make it clear to end-users how and why a particular reconstruction was produced.

One of the tasks of 3D-ICONS was, therefore, to update the CARARE schema by adding classes or entities and properties that would have made the original schema compliant to the 3D-ICONS requirements. Besides, as CARARE works like an intermediate schema between existing European standards and the EDM, another step was to check the compatibility between CARARE and the latest developments in the EDM. In Deliverable D6.1, both issues will be addressed and discussed with special attention given to an extension to the CIDOC-CRM called CRMdig. Thanks to the recent developments of integration between CARARE and the EDM, and to the publication of object templates of the EDM, the updating of CARARE results are simplified. The last OWL version of the EDM has been aligned to CIDOC-CRM Core Classes and some properties of CIDOC-CRM has been reused in EDM allowing a more simple integration of CRMdig into EDM.

The areas of interest of provenance and paradata are innovative for the CARARE schema but it is possible to add this information without changing substantially the original schema and the mapping to the EDM.

More detailed information about the metadata schema adopted by 3D-ICONS is available in Deliverable D6.1 “Report on Metadata and Thesauri”. This also addresses the quality assurance methods adopted for the metadata.

For the collected data some information was also gathered that was needed for a preliminary assessment of the quality, usability and usefulness of the data.

screenshot(s): at least one good view of the entire object, if possible some details. The detail shot should aim at showing the ‘best’ parts of the model as well as the ‘problems’ or limitations of the model. We will provide some guidelines for the screenshots (minimal resolution, background, shading).

technology used: 3D active scanning range sensing (specifying if laser scanning with triangulation, laser scanning with direct distance measurement (TOF, Phase Deviation, FM-CW), structured light, TOF, interference, conoscopy, etc.); 3D passive techniques as photogrammetry and dense stereo matching, freeform surface- or volume-based modelling (from historical data, archaeological hypotheses, etc.).

colour information: specify if the model has some appearance information like per-vertex colour, texture map with parameterization, multiple texture maps with parameterization, projective texture(s), photos aligned with the 3D data.

normals: for point clouds datasets, specify if the points have normals.

software used: the software(s) used in data processing.

available resolutions: specify the size (in Vertices and MB) of the master model, and of the available reduced resolution models; this is important for very large datasets (where special tools are used to generate the larger LODs), it is clear that for smaller datasets (less than 10M triangles) it is possible to generate every possible resolution.

sampling resolution: if the 3D model has been created using sampled data, the sampling rate of the measurements, in terms of minimum/maximum. If multiple 'scans' have been carried out, this value may vary quite a lot from one scan to another or from one part of the object to another; a min-max value will be enough.

Reconstructing resolution: the resolution used to generate the master 3D model from raw data; this does not mean the current triangle count of the model, but the detail/accuracy at the moment of the creation of the master model. If some simplification of the model is performed we should report the error introduced with such an action (in most cases it is less than the reconstruction resolution).

problems: a description of problems of the dataset, like incomplete areas, noisy data, errors in sampling/alignment/reconstruction (this is just for internal use, to know in advance possible problems in manipulating the dataset).

In order to collect usable metadata, a thesaurus will be provided for the above items.

6 IPR

It is well known that the intellectual property rights of 3D scanned dataset can be very complicated. While it is hoped that a major legal position could be stated by some of the major legal authorities in Europe (like, for example, the Italian Ministry of Culture), the project recognizes that it has to manage the fact that most of the data will not in practice be freely available to the casual user.

The possible interpretation of the actual intended use of the 3D data in Europeana could range between the two following extremes:

> [**Restrictive**] Only the metadata about 3D entities collected and produced during the scope of the project are supplied to Europeana. There is no direct access to the 3D data for the general casual user, but in the metadata there is clear information about how the 3D data may be accessed and the physical person responsible for the data who should be contacted about this.
>
> [**Liberal**] All the data collected/produced are directly available to any user of Europeana either in a direct downloadable format, or as a link to some repository, or as a 3D model directly viewable on a modern browser.

The choice of the strategy that should be followed should be done as soon as possible and 3D-ICONS will start a discussion on these points. This has been started in D7.1 Initial Report on IPR Scheme.

It is not the purpose of this report to address here many of the issues that are closely related to this point, like for example who will physically keep the data, the existence of a repository, the exact way of accessing the data, etc., but just to ensure that the project starts collecting all the relevant information that will be needed.

7 Methodology for 3D acquisition

The objective of the discussed 3D acquisition technologies is to provide an accurate, measurable, consistent, sourced set of 3D representations that 3D-ICONS would like to collect, archive and organize.

In this section the main technologies/methodologies currently available for these purposes and that have been used to produce the data listed will be briefly discussed.

Historically, an artefact under analysis has been documented by textual description, including dimensions and more recently augmented by photographs. However individual photographs can only record appearance from one direction and the need for enhancing a single view has led to the use of multiple images to improve 2D documentation of 3D objects. As the number of 2D views increases the effective documentation covers more of the underlying 3D object. Here the intent is that sufficient documentation is recorded to create a complete 3D representation, which can then be stored, analyzed and viewed from any direction. Volumetric models with internal structure and models incorporating kinematic properties may be required for full documentation of 3D objects and assemblies, but these are not produced directly by the recording technologies but, rather, require additional processing and modelling.

In recent years the development of the use of techniques for data capture about the surface of three-dimensional artefacts has allowed more geometrical and structural information to be recorded. Several approaches have been developed, each of which addresses different circumstances and records different characteristics of the 3D artefact[1]. The capabilities of different technologies vary in terms of the resolution of the scanning devices; the operational requirements, the ability to operate in different environmental conditions, their requirement for trained personnel in their operations. Some technologies may enable internal microstructure as well as the general geometry of cultural objects to be studied.

Active range sensing technologies work without coming into contact with the artefact and hence fulfill the expectation that recording devices will not come into physical contact with the artefact. In addition, their luminous intensity is limited to relatively small values and thus does not cause material damage (e.g. by bleaching pigments). These two properties make them particularly adapted for the applications in Cultural Heritage, where non-invasive and non-destructive analyses are crucial for the protection of heritage.

Different families of 3D capturing technologies have different properties and can be used according to the nature of the artefacts to be recorded, operational imperatives and the environmental conditions. There is already considerable experience in the 3D-

[1] F. Blais (2004): A Review of 20 Years of Range Sensor Development: Journal of Electronic Imaging Vol. 13 Issue 1 pp.231-255

COFORM consortium about the use of such technologies in the field to undertake digitisation campaigns and create an inventory of cultural sites. However, there are significant variations between their capabilities, which must be taken into account in formulating campaign strategies.

The main techniques for the digital capture of 3D shapes are triangulation-based sensing (active), distance-based sensing (active) and image based reconstruction techniques (passive). (see Figure 1 below).

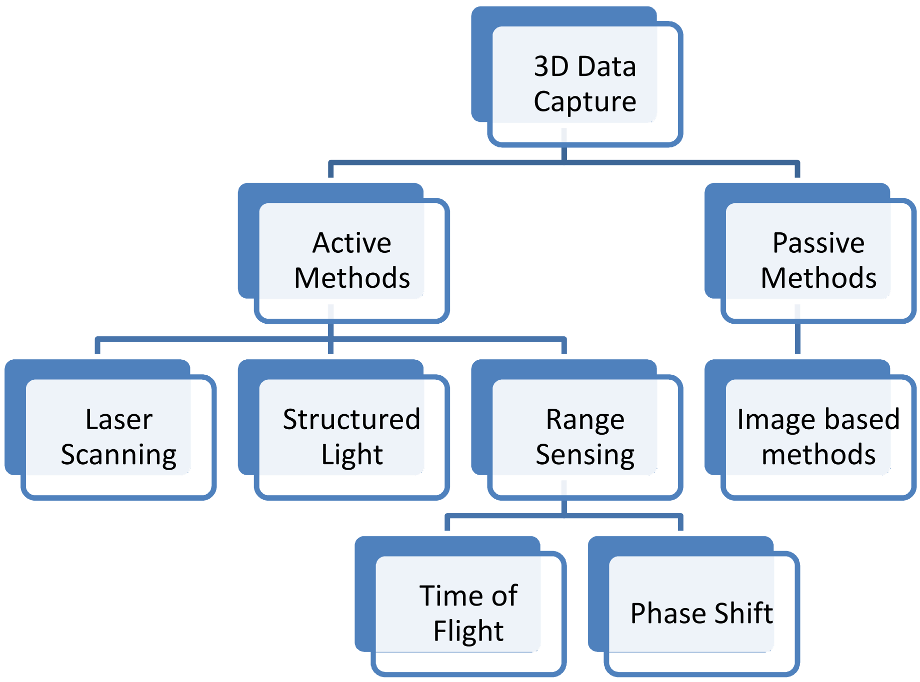

Figure 1: Taxonomy of 3D data capture

For the reasons outlined above, methods of 3D acquisition, which require physical contact, are excluded here. All of these techniques have, as the end point of the documentation, a model of the surface, produced as a set of points in 3D, with alternative methods of constructing a surface on which all the points lie, and, eventually, a colour texture which is attached to the surface at any point. However, the different acquisition technologies affect the inherent characteristics and suitability of the resulting data.

For example, triangulation techniques can produce greater accuracy than time-of-flight, but can only be used at relatively short range. Thus, where great accuracy is a requirement, it can normally only be provided with access to the object to be digitised from perhaps less than 1m and thus, if physical access to the artefact is difficult or requires the construction of special gantries, other constraints come to bear (e.g. using non-invasive techniques and limitations of cost in digitisation). Alternatively, if on a specific site physical access is impractical without unacceptable levels of invasive methods, then sensing from a greater distance may require direct distance measurement techniques (TOF, Phase Deviation) and the results with current technologies may be less accurate.

These limitations of specific technologies are not user requirements – the user may require a level of accuracy and costs for their application to be practical and any technology that can deliver this combination would meet these requirements. However, for practical implementation in the current state of the art, a specific combination may limit the technologies that can deliver.

In all cases, the sensors deliver a set of views that give the depth from the sensor of each visible point on a surface. To document a complete surface including occlusions, several scans need to be aligned and combined. The methods used to complete this process are an intrinsic part of the documentation technique and may be built into the package available from a particular scanning tool. This challenges the definitions of what might be considered the 'original' raw data from the point of view of user requirements that include storing 'original' data for potential later processing as the combination techniques improve. However, it remains the case that many users believe that long-term preservation of the 'raw' data is a requirement, without an in-depth understanding of the implications of the requirement or an agreed interpretation of the definition of 'raw' in this context. Indeed the definition will vary according to the technology in question and genuinely raw data may be less useful than the first stage of processed data in the longer term. The user requirement is probably best expressed as the long-term storage of the initial data produced as input to application level processes.

Part of the processing that leads to the creation of a complete 3D model involves the recognition and removal of any parts of a scan that do not record the artefact itself but the background to it in the scanning location. This cleaning of the scan data is another aspect of the complete recording process and as such is a potential opportunity for errors to become introduced. User requirements are for the background to be safely and easily identified and removed from the raw scans. This process also complicates the definition of 'raw' data and the perceived requirement for its preservation.

There is a well-recognized need for the recording process to include information about the specific hardware and software used in the process and increasingly instruments are designed to include this data automatically. Some instruments also include some environmental data automatically e.g. date, time, and GPS recording are becoming commonplace and the likelihood of recording of other items (e.g. temperature) is increasing. This trend is likely to continue.

A triangulation based laser scanner normally consists of a laser source (generally a laser diode,) and a camera. The laser light reflected from an object is acquired by a CCD camera and 3D data is then created by triangulation to determine distance information. The working principle is based on the optical triangulation: a light source illuminates an object and an image of this light spot is then formed, by means of a lens, on the surface of a linear light sensitive sensor. By measuring the location of the light spot image, the distance of the object from the instrument can be determined, provided the baseline and the angles are known. This type of instrument therefore computes the 3D position on the surface based on triangulation.

7.1 Structured-light range devices

Figure 2: La Gioconda, Mona Lisa, painted by Leonardo da Vinci, inv. n. 779, Paintings dept., Louvre Museum. Acquisition with structured light.

Three-dimensional acquisition using a particular pattern of white light is called 'structured light' or 'fringe projection' 3D acquisition. It consists of projecting a series of alternated dark and bright stripes on an object and to record the deformed patterns of light with a camera. The projector and the camera being usually fixed on a rigid column, and forming a known angle, it is possible to measure all the parameters of the triangle formed by the camera, the projector and a projected fringe (Figure 2). The projection of structured light on an object can be observed from a different perspective as a deformed pattern according to the shape of the object. Structured light systems are therefore an alternative triangulation method.

Triangulation methods can achieve the greatest accuracy of current technologies with accuracy below 0.2mm depending upon the instrument and the scanning setup. Where the object surface has overhangs and parts that are not directly visible, the scans presents holes and missing parts. Most of these gaps can be filled by and combining scans from several different orientations.

7.2 Direct Distance measurement

Time-of-flight scanners (also called ranging scanners) are a large set of devices that are able to get punctual distance information by exploiting a pulsed laser beam that is reflected by the surface of the object to be scanned. Most of these devices are based on the measuring of the time spent by the light to return to a laser receiver to compute the distance of the point of reflection, using an assumed speed of light. Ranging scanners are able to measure much longer distances than instruments that work by triangulation. They are, however, less accurate and especially so at close range. The accuracy is between a few millimetres and two or three centimetres, depending to some extent on the distance between the object and the scanner (object distance). Other techniques based on or phase-shift approaches are now getting common and are able of greater precision (at the expense of a slower acquisition speed)

Time-of-flight scans may provide a wider reference framework into which the results of more accurate triangulation scans can be placed.

7.3 Image Based Technologies

Photogrammetry is the analysis of two-dimensional photographs to extract three-dimensional information. At least two images are necessary to reconstruct a three-dimensional model of the object. Homologous points are set on the pairs of images, the intersection of light rays going from an object point to a camera allows to produce the three-dimensional co-ordinates of the points of interest. This technique operates on the same principle as the human vision system. The main advantages of such an approach are the simple instrumentation needed, usually one or more digital cameras, and the speed of acquisition. The accuracy of the digitised models, however, is tied to a number of different factors (baseline, accuracy of calibration, adequacy of the reflectance behavior of the object) and can vary a lot from microns of small object acquired in very controlled laboratory settings to tens of decimeters for real-world architectural entities.

8 Methodology for Post Processing

The post processing methodology concerns three main aspects: the geometric reconstruction, the visual enrichment and the semantic structuring of the model. According to the final representation purpose (documentation of the actual state of the artifact, virtual reconstruction of hypothetical past states, visualization of temporal transformations, etc.). 3D digitisation can be integrated in a more complex representation system including other graphic sources (such as plans, cross-sections, elevations, sketches, paintings, etc.) and requiring the semantic structuring of the artifact morphology.

8.1 3D geometric reconstruction

3D reconstruction techniques will be chosen according to the morphological complexity of the artifact and to the desired (or needed) degree of consistency with the real object. The list of techniques below is ordered from techniques providing a high geometric consistency with the real object to the techniques introducing increasingly approximations.

- Automatic mesh from a dense 3D point cloud;
- Interactive or semi-automatic reconstruction based on relevant profiles;
- Interactive or semi-automatic reconstruction based on primitives adjustment;
- Interactive reconstruction based on technical iconography (plans, cross-sections and elevations);
- Interactive reconstruction based on artistic iconography (sketches, paintings, etc.).

8.2 Visual enrichment

With regard to the visual enrichment of 3D reconstructions, this project will focus primarily on techniques based on the acquisition of the real visual appearance of surfaces that are consistent with the geometry of the object (image-based techniques). Moreover, other techniques for enriching visually the 3D geometry (e.g. hypothetical reconstruction) will be taken into account:

- Texture extraction and projection starting from photographs finely oriented on the 3D model (e.g. image-based modeling, photogrammetry);
- Texturing by photographic samples of the real materials of the artifact;
- Texturing by generic shaders (e.g. procedural texturing, the appearance of the surface is automatically generated according to some parameter, adequate for certain class of materials like stone, wood etc.).

8.3 Semantic structuring

3D geometric reconstructions can lead to a representation of artifact shapes composed by a single geometric mesh as a collection of separate geometric entities structured according to several criteria. Depending on relevant documentation and disseminations purposes, a semantic structuring of the 3D reconstruction will be chosen. In some cases, this step will be conducted collaborating with a scientific officer in order to ensure consistency in structuring the 3D entities according to metadata.

The 3D model resulting from the geometrical reconstruction will be structured in different ways:

- Decomposed in entities
- Decomposed in entities hierarchically organized (e.g. architectural layouts)
- Decomposed in entities organized in classes (e.g. materials of types of elements)

The semantic structuring of 3D models is directly related to the strategies for linking 3D models to metadata or other documentary sources (link to the WP5: Publication of content online). According with the structuring of 3D models, heterogeneous data will be linked to:

- The 3D representation to the entire object (such as descriptive information accompanying a complete 3D model);
- Relevant parts of the 3D representation of the object (heterogeneous data are structured according to the structure of the 3D model);
- A model of semantic description of the object (heterogeneous data are connected on one side to the parts of a 3D representation and on the other side to general concepts – e.g. ontology);

8.4 Hypothetical reconstruction

The hypothetical reconstruction of heritage artifacts is primarily related to archaeological and historical issues. The methodology for the elaboration of hypothetical reconstructions will be based on several approaches:

- the 3D acquisition of existing (or existed) parts;
- previous 2D surveys of existing (or existed) parts;
- non-metric iconographic sources of the studied artifact;
- iconographic sources (metric and / or non-metric) related to similar artifacts;

(Some) hypothetical reconstructions will be conducted in collaboration with scientific advisors. Resulting 3D models will preserve links towards bibliographic and iconographic references used during the hypothetical reconstructions process.

9 Digitisation and Scheduling of Operations

Partners were initially required to produce a Digitisation Plan to indicate the monuments they intended to digitize, the content (3D models, images, videos etc.)

Each partner produced a Digitisation Plan based upon the information provided in the original Document list. The Plan provided a high-level overview of the models planned for production along with:

- A brief description of the planned digitisation methods to be used.
- A brief description of the planned post-processing methods to be used.
- Completion date for each stage denoted as quarter years, i.e. Q5 for May 2013, Q6 for August 2013 etc.

Additional fields were be added to the Documented list summary page that were to be maintained and updated by each partner on a 3-monthly basis for project monitoring and reporting purposes with regard to the completion dates. Examples of the tables to be used are as follows:

	Entity	Entity Models	Details	Detail Models
CISA	15	14	15	42

Table 2: Current Table Entry

	Entity	Entity Models	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
CISA	15	14	1	2	2	3	3	2	1	0
	Completed	1	1	0	0	0	0	0	0	0

Table 3: Modified Entity table entry for the Digitisation Plan

And

	Details	Detail Models	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
CISA	15	42	6	6	6	6	6	6	6	0
	Completed	3	3	0	0	0	0	0	0	0

Table 4: Modified Detail table entry for the Digitisation Plan

Deviations or changes in the Digitisation Plan were to be recorded so that this information can be used when defining the planned production pipeline for 3D-ICONS in Year 3.

However, the Digitisation Plans have been superceded by the implementation of the Monitoring Database where a more detailed process has been used with defined checkpoints. For each item (entity/detail), a planned and actual completion date is required (as quarters Q5-Q12) against each checkpoint. The checkpoints are based upon discrete stages in the process pipeline which are also related to the Work Packages (WP) of the 3D-ICONS project as follows:

- WP3 digitisation – the date at which the monument/entity data has completed capture of the data.
- WP4 Modelling – completion of the processing and modeling of the data into a file in a standard 3D data format
- WP5 Conversion – conversion from the original 3D data format into an output(s) designed for viewing of 3D models by Europeana end users.
- WP6.2 Metadata creation – completion of the metadata associated with the 3D model
- WP6.2 Uploaded to MORE2 – metadata uploaded and converted to EDM in the MORE2 repository
- WP6.2 Quality verification – both the digitised object and metadata is checked for quality and conformance to the defined quality criteria (some checks are performed automatically by MORE on the metadata).
- WP6.3 Europeana delivery (ingested) – the metadata is ingested by Europeana from MORE.
- WP6.3 Europeana delivery (published) – the point at which the metadata of the model appears in Europeana. Europeana usually publishes on a monthly schedule but occasionally this may get delayed.
- WP6.3 3D-ICONS Portal delivery – the relevant data is supplied to the 3D-ICONS portal.

Note that the checkpoints for associated digital items such as images and videos apply from WP6.2 onwards.

All the partners were asked to at least specify the completion date for each cultural entity/detail. For the entities that have to be completed within Year 2, the partners have been asked to compete the planned date for all the other checkpoints in the next two months.

Consequently, a Digitisation Plan as encapsulated within the Monitoring Database is now of the format for a 3D model:

CISA **Completion Planned Date**

WP	WP3	WP4	WP5	WP6					
Checkpoint	Digitisation	Modelling	Conversion	Metadata creation	Uploaded to MORE2	Quality verification	Ingested into Europeana	Published by Europeana	3D-ICONS Portal
Quarter									
Q5	1	1							
Q6	2	1	3	1	1				
Q7	2	2	2	5	5	1			
Q8	3	2	2			5	3		
Q9	3	3	2	3	3	3		3	3
Q10	2	3	3	3	3		6		
Q11	1	3	3	3	3	6	6	6	6
Q12	0							6	6
Total	14	15	15	15	15	15	15	15	15

Note: one model was already digitised before Q5.

Table 5: Digitisation schedule as it appears in the Progress Monitoring Tool

9.1 Digitisation Targets

For the purpose of monitoring progress, the following digitisation targets have been set for each partner. These also include a target date for the signature of the Europeana Data Agreement (there are still a few partners who have not completed this task) and IPR clearance as this has a serious impact on both the schedule and the number of 3D models that each partner ultimately delivers to 3D-ICONS.

The first two targets are for the monuments, i.e. the complete sites or buildings as IPR and digitisation campaigns usually apply at this level. The next target applies to 3D Models only and the last three to all the digital content being supplied by each partner. The Monitoring Reports from the Database will provide more detailed information in addition to these targets, which will be reported in the Progress Reports for M18 onwards.

Partner name: CISA

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation		2	1	0	0	**3**
3D acquisition completed on monument complexes		1	1	1		**3**
3D post processing completed on 3D models per quarter		20	30	30	10	**90**
Metadata completed for 3D models, images, videos etc.		60	300	300	158	**818**
3D models, images, videos etc. published online			250	400	168	**818**
Metadata and content made available to Europeana			50	300	468	**818**

Target monuments for digitisation

1. Pompeii & Herculaneum (UNESCO WH site)
2. Historic centre of Naples (UNESCO WH site)
3. Paestum (UNESCO WH site)

Partner name: CNR-ISTI/CNR-ITBAC

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18		Yes				
Monuments with IPR rights cleared for 3D digitisation	6	18	3			**27**
3D acquisition completed on monument complexes	3	2	9	12	1	**27**
3D post processing completed on 3D models per quarter		50	150	150	11	**361**
Metadata completed for 3D models, images, videos etc.			50	1000	615	**1665**
3D models, images, videos etc. published online		0	50	800	815	**1665**
Metadata and content made available to Europeana				500	1166	**1666**

Target monuments for digitisation

1. Piazza dei Miracoli, Pisa (UNESCO WH site)
2. San Gimignano (UNESCO WH site).
3. Historic Centre of Rome (UNESCO WH site)
4. Historic Centre of Florence (UNESCO WH site)
5. Basilica of Assisi (UNESCO WH site)
6. Matera (UNESCO WH site)
7. Pompeii (UNESCO WH site)
8. Ferrara (UNESCO WH site)
9. Appia Archaeological Park
10. Cerveteri Necropolis
11. Estense Castle
12. Lucus Feroniae
13. Sarmizegetusa
14. Via Flaminia
15. Villa of Livia
16. VIlla of Volusii
17. Ara Pacis
18. Badia Camaldolese
19. David_Donatello
20. Ipogeo dei Tetina
21. Loggia dei Lanzi
22. Portalada
23. Ruthwell Cross
24. San Leonardo in Arcetri
25. Sarcofago degli Sposi
26. Tempio di Luni
27. Villa Medicea Montelupo

Partner name: CETI

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation	All					**6**
3D acquisition completed on monument complexes		2	2	2		**6**
3D post processing completed on 3D models per quarter		6	12	12	6	**36**
Metadata completed for 3D models, images, videos etc.			120	150	72	**342**
3D models, images, videos etc. published online			60	200	82	**342**
Metadata and content made available to Europeana			60	150	132	**342**

Target monuments for digitisation

1. Monastery of Panagia Kosmosotira
2. Monastery of Panagia Kalamou
3. Church of Acheiropoietos
4. Church of Agioi Apostoloi
5. Rotunda
6. Kioutouklou Baba Bekctashic Teke

Partner name: DISC

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation	All					
3D acquisition completed on monument complexes	4	3	1	2		**10**
3D post processing completed on 3D models per quarter		20	30	20	11	**81**
Metadata completed for 3D models, images, videos etc.			50	300	117	**467**
3D models, images, videos etc. published online			20	320	127	**467**
Metadata and content made available to Europeana				300	167	**467**

Target monuments for digitisation

1. Brú na Bóinne (UNESCO WHS)
2. Skellig Michael (UNESCO WHS)
3. Hill of Tara – Royal Site (UNESCO WHS candidate)
4. Dún Ailinne – Royal Site (UNESCO WHS candidate)
5. Rathcroghan – Royal Site (UNESCO WHS candidate)

6. Western Stone Forts (UNESCO WHS candidate) - Dún Aonghasa Stone Fort, Aran Islands; Dún Eochla Stone Fort, Aran Islands; Dún Chonchúir Stone Fort, Aran Islands; Dúcathair Stone Fort, Aran Islands; Dún Eoghanachta Stone Fort, Aran Islands; Cahercommaun Stone Fort, Burren; Staigue Stone Fort, Kerry
7. Clonmacnoise Monastic City (UNESCO WHS candidate)
8. Glendalough Monastic Site (UNESCO WHS candidate)
9. Navan Hillfort, County Armagh
10. City of Derry/Londonderry's Walls

Partner name: UJA-CAAI

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation		3	1			**4**
3D acquisition completed on monument complexes		1	2	1		**4**
3D post processing completed on 3D models per quarter			151	300	65	**516**
Metadata completed for 3D models, images, videos etc.			50	250	291	**591**
3D models, images, videos etc. published online			50	250	291	**591**
Metadata and content made available to Europeana			50	250	291	**591**

Target monuments for digitisation

- Iberian culture - Oppidum of Puente Tablas (Jaén): overall structure and details of the oppidum
- Iberian culture - Necropolis of Fuente Piedra (Málaga): overall model, grave goods
- Iberian culture - Burial Chamber of Toya (Jaén): overall model
- Iberian culture - Burial Chamber of Piquía (Jaén): overall model and grave goods
- Iberian culture - Burial mounds of Tútugi (Granada): overall model, grave goods
- Iberian culture - Sculptoric Group of Porcuna (Jaén): overall model, grave goods
- The Rockshelter of Engarbo I and II (Santiago-Pontones, Jaén), part of the UNESCO WH site "Rock Art of the Mediterranean Basin on the Iberian Peninsula"

Partner name: CMC

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18		Yes				
Monuments with IPR rights cleared for 3D digitisation		1	5			**6**
3D acquisition completed on monument complexes		0	3	3	0	**6**
3D post processing completed on 3D models per quarter			3	3	0	**6**
Metadata completed for 3D models, images, videos etc.			20	80	22	**122**
3D models, images, videos etc. published online				100	22	**122**
Metadata and content made available to Europeana				100	22	**122**

Target monuments for digitisation

1. Skara Brae monuments - 6 components

Partner name: Polimi

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18			Yes			
Monuments with IPR rights cleared for 3D digitisation	All					**11**
3D acquisition completed on monument complexes		2	6	3		**11**
3D post processing completed on 3D models per quarter	55	140	200	132		**527**
Metadata completed for 3D models, images, videos etc.		50	200	1000	301	**1551**
3D models, images, videos etc. published online		200	200	700	451	**1551**
Metadata and content made available to Europeana			200	700	651	**1551**

Target monuments for digitisation

1. Historic Centre of Milan - Basilica's crypt of San Giovanni in Conca (Milan): overall model and reconstructions
2. Historic Centre of Milan - Poligonal tower with frescoes
3. Historic Centre of Milan – Palazzi dei Portici of Piazza Duomo
4. Historic Centre of Bergamo – Gate of San Giacomo
5. Various archaeological objects from the Historic Centre of Milan, now in the Archaeological Museum
6. Certosa di Pavia - Sacrestia Nuova
7. Certosa di Pavia - New Library (Certosa di Pavia)

8. Certosa di Pavia - Old Library (Certosa di Pavia)
9. Certosa di Pavia - Small Cloister (Certosa di Pavia)
10. Certosa di Pavia - Monk cell (Certosa di Pavia)
11. Certosa di Pavia – Architectural details: small statues and bass reliefs, from the Carthusian museum

Partner name: Archaeotransfert

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation	All					**0**
3D acquisition completed on monument complexes		2	2	1	1	**6**
3D post processing completed on 3D models per quarter			20	30	26	**76**
Metadata completed for 3D models, images, videos etc.			750	3000	1270	**5020**
3D models, images, videos etc. published online			20	3000	2000	**520**
Metadata and content made available to Europeana				3000	2020	**5020**

Target monuments for digitisation

1. Citadelle de Blaye (UNESCO WH): 3D models of the citadelle, maps, iconography, photos, texts (as scan)
2. Abbaye de La Sauve-Majeure (UNESCO WH site of Santiago de Compostela): overall and detail models, images and related texts (as scan)
3. Historic Monuments of France: Chateau d'Abbadie à Biarritz, overall and detail 3D models, photos
4. Historic Centre of Rome (UNESCO WH site): Piazza Navona. 3D models of the buildings and fountains. Photos, iconography
5. Non-prehistorical heritage of the Vézère valley: Audrix village. 3D models of the village through time (about 50 buildings). Photos, iconography and texts as scans
6. Historic Centre of Rome (UNESCO WH site): Circus Maximus. Overall 3D model + details, Titus arc foundation, cavea, stairwell, medieval tower, other minor remains

Partner name: FBK

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18		Yes				
Monuments with IPR rights cleared for 3D digitisation	3	3				**6**
3D acquisition completed on monument complexes	1	2	2	1		**6**
3D post processing completed on 3D models per quarter	5	10	20	22		**57**
Metadata completed for 3D models, images, videos etc.			130	300	175	**605**
3D models, images, videos etc. published online			50	250	305	**605**
Metadata and content made available to Europeana				250	355	**605**

Target monuments for digitisation

1. Tomba dei Rilievi, Cerveteri, IT (UNESCO WH site): geometry and texture
2. Tomba degli Auguri, Tarquinia, (UNESCO WH site): geometry and texture
3. Three Picks of Lavaredo, Dolomiti, (UNESCO WH site)
4. Stenico castle, Stenico, Italy
5. Torre Aquila and Stanza dei Mesi, Buonconsiglio castle, Trento, Italy
6. Various objects from the collections of the Buonconsiglio castle, Trento, Italy

Partner name: KMKG

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation		All				**0**
3D acquisition completed on monument complexes						**0**
3D post processing completed on 3D models per quarter		50	100	150	150	**450**
Metadata completed for 3D models, images, videos etc.			50	200	200	**450**
3D models, images, videos etc. published online				250	200	**450**
Metadata and content made available to Europeana				250	200	**450**

Target monuments for digitisation

1. Grave goods from the Almeria Necropolis, Spain

Partner name: CYI-STARC

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation			All			**1**
3D acquisition completed on monument complexes			1			**1**
3D post processing completed on 3D models per quarter			30	53		**83**
Metadata completed for 3D models, images, videos etc.				550	33	**583**
3D models, images, videos etc. published online				350	233	**583**
Metadata and content made available to Europeana				350	233	**583**

Target monuments for digitisation

1. Monuments and buildings from the Green Zone, Nicosia

Partner name: MAP

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18			Yes			
Monuments with IPR rights cleared for 3D digitisation	All					**0**
3D acquisition completed on monument complexes	6	2	2			**10**
3D post processing completed on 3D models per quarter		133	50	100	40	**323**
Metadata completed for 3D models, images, videos etc.			220	800	360	**1380**
3D models, images, videos etc. published online			100	1000	280	**1380**
Metadata and content made available to Europeana				500	880	**1380**

Target monuments for digitisation

1. Château Comtal de Carcassonne (UNESCO WH site): 3D models and reconstructions at various times.
2. Paris, Arc de Triomphe (iconic monument of Paris): 3D models, overall and in detail, pictures
3. Saint Louis Church in Mont-Dauphin (national historic monument): 3D models and pictures
4. Cloister of the Saint-Guilhem-le-Désert Abbey (national historic monument): 3D models and reconstructions
5. Sculpted elements of the Saint-Guilhem-le-Désert Abbey (arcstones, columns, basis, capitals, etc.)

6. Le trophée des Alpes, La Turbie (national historic monument): remains of the Roman monument to August. 3D model and reconstructions
7. Chartreuse de Villeneuve-lez-Avignon (national historic monument): overall and detail 3D models, images
8. Petit Trianon, Versailles (UNESCO WH site): 3D model, reconstruction, images
9. Petit Trianon, Versailles: furnishings, artworks, paintings etc. (UNESCO WH site)
10. Centre Pompidou, Paris (masterpiece of contemporary architecture): 3D model, images

Partner name: MNIR

	M12	M18	M24	M30	M36	Total
Europeana Data Exchange Agreement signed by M18	Yes					
Monuments with IPR rights cleared for 3D digitisation	Yes					**3**
3D acquisition completed on monument complexes		1	1	1		**3**
3D post processing completed on 3D models per quarter		15	25	30	25	**95**
Metadata completed for 3D models, images, videos etc.			122	470	263	**855**
3D models, images, videos etc. published online			100	400	355	**855**
Metadata and content made available to Europeana			100	400	355	**855**

Target monuments for digitisation

1. Sfintul Mihail Cathedral, Alba-Iulia (11-12 century monument candidate for Unesco World Heritage list)
2. Funerary stones, liturgical silver objects, paintings, documents and costumes from the St. Mihail Cathedral Museum, Alba-Iulia
3. Dacian Fortresses of the Orastie Mountains (UNESCO WH site): Architectural remains and archaeological artefacts found in the Sarmisegetusa compound.

10 Case Studies

A selection of Case Studies to be produced by 3D-ICONS which illustrate the variety of approaches that can be used to produce the resulting 3D Models and associated metadata will be chosen based upon the information provided in the Document List. These case studies will be provided as examples of the 3D-ICONS process and will form part of the available documentation. The subjects selected are as follows:

- Case Study 1 – The Kioutouklou Baba Bekctashic Tekke
- Case Study 2 – Etruscan tomb
- Case Study 3 – A throne
- Case Study 4 - A marble fragment
- Case Study 5 – A Cycladic Female Figurine

These topics cover a wide range of monuments and details in terms of size (small artefact to large building), materials and acquisition and processing methods.

11 Available Document List

At the end of this section is a report generated by the Progress Monitoring Tool containing an updated list of monuments, sites and objects to be provided by 3D-ICONS. This list may be updated further during the lifetime of the project as new material may be added or some items may have to be removed for reasons such as quality or IPR. Partners may also wish to add new items and external contributors may also join the project. All changes that will happen to the list of items will be discussed by the partner with the Project Coordinator with the purpose of maintaining the overall amount of provided data in line with the Description of Work (Annex I).

11.1 Methodology

Starting from the initial list stated in the DOW, information was provided to the partners about the data granularity who were asked them to provide further details about the planned acquisitions and existing data. It was soon discovered that due to various reasons (IPR uncertainty, logistic campaign difficulties, etc.) this collection was a much more dynamic entity than originally forecast and that the management of this data was a complex task. As a solution, an online database was implemented as a data collection tool that was released to the partners for collecting/updating and checking their data. This tool was a limited functionality prototype ingestion tool that allowed to the partners to describe the entity/details and models that they planned to provide according to the model described in this deliverable.

The tool was used during the first 15 months of the project and when the Monitoring Progress tool became available, use was discontinued. All the data collected with this tool was translated and automatically ported to the newly developed Monitoring Progress tool.

The data collected in the first database contained the following information:

11.2 Entity

- Provider: *Acronym of the partner*
- Identifier: *Just a short unique string describing this item. It is used just internally in the project to informally identify this item.*
- Number of models: *The number of models that are provided for this item; it should correspond to the number of lines supplied to the Model table and that refer to this item.*
- Number of images: *The number of models provided for this item*
- Number of videos: *The number of models provided for this item*
- IPR notes: *Free text clarifying if you have some rights for the 3D data, who can eventually access the data and whether there is some possibility of publishing them.*

11.3 Detail

Basically the same information for *Entity* except with the need also to know what is the *Entity* this *Detail* belongs to.

- Provider: *Same as in Entity*
- Entity: ***The entity this detail belongs to***
- Identifier: *Same as in Entity*
- Number of models: *Same as in Entity*
- Number of images: *Same as in Entity*
- Number of videos: *Same as in Entity*
- IPR notes: *Same as in Entity*

11.4 Model

- Entity/Detail: *The identifier of the entity or the detail that it refers to*
- Identifier: *Same as in Entity*
- Screenshot: *A representative screenshot of the model. It should be square, at least 1024x1024 pixels in dimension, it should cover the entire object (no detail). Simply paste the screenshot in the worksheet.*
- Class: *Can be either "modeled" or "from survey".*
- Technology: *Free text, describing the technology used roughly one sentence, less than 256 characters.*
- Format: *Can be either "Point Cloud" or "Surface". The rationale is that anything that is ready to be rendered into a standard 3D modeled is a surface (not depending on the fact that it is a survey or a modeled object), otherwise it is a point cloud.*
- Complexity: *Number of Vertex for point clouds, number of polygons/triangles for surface models.*
- Colour: *Yes/No. The reflectance information of a time of flight should not considered as colour.*
- Issues and notes: *Free text.*

11.5 Full List of Current Monument, Entities and Details

The separate PDF report "3D-Icons_MPT_Report-20130613.pdf" provided with this revised document have been extracted from the newly deployed Progress Monitoring tool and reports the current status of all the collected information for Monuments, Entity and Details. The information reported in this table has a slightly different structure due to the different underlying database structure. An accurate description of it is present in the *WD 6.2 – 3D Progress Monitoring Tool: Database Structure.* The attached table reports, as requested, the information necessary to assess **what** will be digitised in terms both of cultural entities and details and models. For the models, it reports the information needed to assess the quantity of work with the 'size' indicators outlined in the DoW and defined in the previous section. The list also reports, when was possible to have an estimate, the forecasted completion date. Due to the very limited time between the completion of the Progress Monitoring Tool and the delivery of this report, it was not possible for all the partners to fully complete their data entry. This will task will be continued and completed by the end of M18 in time for the next Progress Report.

11.6 Summary Table of 3D Models by Partner

The following table reports, for each partner providing content, the cumulative numbers in terms of monument, entities and details, their size and if they have been acquired before the start of the project.

Note that it is expected for partners to add further models over the next 18 months as some IPR clearance is still under negotiation, some model numbers have been estimated and may end up higher and additional external contributions are also expected. 3D-ICONS aims to provide the 3,000 3D-models to Europeana as stated in the DoW.

Partner	Monuments	Entities	Details	3D Models	Pre-existing	New	D>50	50m>D>10m	10m>D>2m	2m>D>0.8m	80cm>D>10cm	10cm>D>2cm	2cm>D
ARCHEOTRANSFERT	6	6	0	76	0	76	0	0	0	0	0	0	0
CETI	6	6	11	36	0	36	10	2	1	23	0	0	0
CISA	16	16	17	90	0	90	9	31	44	5	1	0	0
CMC	8	8	0	21	0	21	0	0	0	0	0	0	0
CNR-ISTI*	17	21	17	176	76	100	8	34	45	53	36	0	0
CNR-ITABC*	11	125	9	152	125	27	27	27	85	7	6	0	0
CYI-STARC	14	14	2	83	0	83	0	0	0	0	0	0	0
DISC	21	64	47	109	4	105	28	13	30	11	1	2	0
FBK	9	11	3	57	11	46	5	16	12	3	21	0	0
KMKG	1	1	1	450	0	450	0	0	0	250	200	0	0
MAP-CNRS	19	19	7	323	133	190	59	32	15	189	28	0	0
MNIR	3	3	2	95	15	80	2	0	10	44	24	0	0
POLIMI	4	100	1	527	55	472	8	45	10	34	429	1	0
UJA-CAAI	7	5	3	516	8	508	3	0	1	255	257	0	0
VisDim	1	8	0	50	50	0	26	24	0	0	0	0	0
Total (All providers)	143	407	120	2761	477	2284	185	224	253	874	1003	3	0

*CNR-ISTI and CNR-ITABC are different departments of the same partner, CNR.

Table 6: Partner's 3D Data Summary as provided by the Progress Monitoring Tool

12 Conclusion

This report provides the framework for the definition of the items to be digitised so that this information can be recorded and monitored as the work progresses. It was as a result of the preliminary work for this report that the Progress Monitoring Tool was realized as it became evident that a more sophisticated approach was needed to keep track of the large quantity of digitised objects (i.e. 3D models, images and videos) as each progressed through a series of checkpoints in the process. This also led to some refinements of the original descriptions in the DoW such as the finite size specifications and the hierarchical monument – entity – detail structure.

The project partners will use a variety of digitisation and post-acquisition methodologies to produce 3D models – these are not proscribed as each partner will use the tools and methods that are considered appropriate for the type of model they are producing. Five case studies have been identified which will provide an overview of the 3D-ICONS process pipeline applied to a variety of items (large to small) using different approaches.

The digitisation and scheduling of operations was strengthened by the introduction of the Process Monitoring Tool as this has enabled the complete process with defined checkpoints to be embedded within the tool so that partners can record their progress against each item and for the project manager to obtain reports of this progress against the checkpoints at any given point in time. For this purpose, a set of digitisation targets have been set for each partner and so their progress can be individually monitored and reported in all subsequent Progress and Management Reports from M18.

13 References

3D-ICONS website: http://www.3dicons-project.eu

3D-ICONS Description of Work (DoW) : " 3D Digitisation of Icons of European Architectural and Archaeological Heritage " - Grant agreement no: 297194.

Deliverable D6.1 “Report on Metadata and Thesauri”.