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The Challenge of Preservation of Cultural Heritage in Digital Form

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Declaration

I, Patric Moreno hereby declare that this thesis, entitled "The Challenge of Preservation of Cultural Heritage in Digital Form", submitted as partial requirement for the MA Programme Euroculture, is my own original work and expressed in my own words. Any use made within this text of works of other authors in any form (e.g. ideas, figures, texts, tables, etc.) are properly acknowledged in the text as well as in the bibliography.

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Signed …….....

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1. INTRODUCTION

1.1 Preservation in Digital Form

As the digital technological developments in today's world are moving forward with an immense speed it has become imperative for the international community to act on how to best preserve digital material for the future. As old analogue material more and more is being digitised, and new born digital material created every day, we are faced with questions on how to preserve all of this material in a sustainable long-term way.

Whenever objects are being digitised or born digital, the problem of preservation arises. The digitisation process creates a digital file, but this file is not automatically preserved at the same time it has been created. Therefore, there is a crucial need for international co-ordination in order to find sound ways to safeguard valuable digital cultural heritage. The objective of this paper is to investigate what digital preservation methods lie ahead of us and what role open-source can have.

1.2 Statement of the Problem

In a digital time preservation of digital cultural heritage poses its own types of challenges on how to preserve and access digital files in the future, this includes both digitised analogue material into digital files, and born digital files, like for example any text file created on a computer today.

This paper is examining conference and workshop proceedings that have been presented at United Nations Educational, Scientific and Cultural Organization (UNESCO), The European Union (EU) and the International Council of Museums (ICOM) in order to see what the current attitudes on digital preservation are, and where the indications and tendencies regarding digital preservation for the future lie.

In the case of ICOM I decided to focus on the working subgroup for museum documentation called CIDOC (Comité International pour la Documentation), which is the international committee on documentation and who also focuses on digital preservation since ICOM itself does not do so.[1] These are three cultural

[1] Stefan Rohde-Enslin, "Digital Cultural Heritage/Preservation," e-mail message to author, May 16, 2014.

organisations/institutions that traditionally are involved with the safeguarding of cultural heritage.

Aside from the examination of the conference proceedings the paper will in addition highlight two aspects related to the topic on cultural heritage in digital form and the challenge it poses. The first one is on museums and their role. A report published by the Library of Congress in 2013 showed that museums are behind in their work of digital preservation strategies compared to archives and libraries.[2]

The second aspect presents how open standards are becoming attractive in the digital world of preservation of digital data. Therefore, the paper exemplifies the work of a memory institution - National Archives of Australia.

The questions of interest that the paper will try to answer are the following:

- What digital preservation solutions for digitised and born digital cultural heritage lie ahead of us?
- What is the current viewpoint on open-source software as a method for digital preservation?
- How can the international community best safeguard our digital cultural heritage?

1.3 Outline

The thesis is divided into four parts where the first chapter includes the introduction and a presentation of previous research and theoretical implications which are followed by the methodology and, scope and limitations.

The second chapter is the background with definitions of cultural heritage and digital cultural heritage; cultural heritage versus digital cultural heritage in museums, which emphasises on the problematic relationship between cultural heritage and digital cultural heritage; digitisation of cultural heritage; digital preservation; and the example of National Archives of Australia.

[2] Madeline Sheldon, "Analysis of Current Digital Preservation Policies: Archives, Libraries and Museums," Library of Congress, last modified August 13, 2013, accessed October 7, 2014, http://www.digitalpreservation.gov/documents/Analysis%20of%20Current%20Digital%20Preservation%20Policies.pdf?loclr=blogsig.

The third part consists of the analysis, results and discussion of the investigated sources of UNESCO, EU and ICOM/CIDOC.

Finally, the fourth part is closing with a conclusion of the study.

1.4 Previous Research and Theoretical Implications

As the field of digital cultural heritage is relatively new and it so far has lacked a clear theory between cultural heritage and the new emerging digital technologies, I decided to use the anthology; *Theorizing Digital Cultural Heritage: A Critical Discourse* to assist me where museums and their role to digitisation and digital preservation was mentioned in the analysed sources. The anthology consists of a number of essays that discuss museums and their role in relation to digital media and digitisation, written by a number of experts in this field specifically for the anthology.[3]

In Western society cultural institutions, like for example museums and libraries, are considered to be authoritarians on the preservation of our past history. In today's information society these cultural institutions are seen as guardians of our intellectual capital. As digital technologies come to play a much more important role the various sectors of cultural heritage are aware of the needs for specialised institutions to deal with it. Nevertheless, many aspects of this issue are not being addressed satisfactorily.[4]

When great transformations take place in society change from conventional ways of conducting work to new modern and sometimes faster ways of doing the same work can be met with caution and suspicion. Some fear that it will lead to a complete break with old established routines, whereas others embrace a forthcoming change.

That it in a digital era has become important for memory institutions to digitise their collections is the following quote an example of:

> Today we are in the era of the post-Internet art museum. Once, art historians said 'it's not in my books or slide library, thus it must not be important.' Now, their students tend to say 'It's not on the Internet. It must not exist.'[5]

[3] Kjetil Sandvik, "Review of 6 Books on Cultural Heritage, Museums and Digital Media," review of Theorizing Digital Cultural Heritage. A Critical Discourse., Academia.edu, accessed August 11, 2014, http://www.academia.edu/890875/Review_of_6_books_on_cultural_heritage_museums_and_digital_media.

[4] Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 3

[5] Peter Walsh, "Rise and Fall of the Post-Photographic Museum: Technology and the Transformation of Art," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 30

The above quote can illustrate the importance of keeping up-to-date with changes in society. It does not necessarily mean that old traditional ways must be abandoned all together, but adaptation is a key factor with any social change to accommodate new growing demands in society.

Andrea Witcomb points to that within the discussions of technology and museums there are two fundamental opposing positions. The one we are used to hear about is characterised by keywords like; authority, evidence, aura, time and knowledge. Whereas the other one, which is represented by today's multimedia, is characterised by words like; immediate, democratic, popular and temporary.[6] This indicates that digital cultural heritage is having problems of being taken as seriously as cultural heritage itself. This is of course of concern as cultural heritage can benefit from new technologies if it does not consider it a threat to its already established framework.

If museums see digital technology as a threat they could consider seeing digital media as an opportunity for them to partly recreate themselves, and in doing so become better prepared of the demands of today's audiences. Though, fear and reluctance to do so is reflected in maybe having to give up its role as institutional authority, not being able to discriminate anymore between the real and "the other", as well as the transformation of having been bearers of knowledge, now transformed into; simply information, available from any digital device. Proponents of change with museums see this as a mean to reach out to their audiences and promote, amongst others, democracy, active learning and multiple meanings.[7]

Cameron reminds us of that French theorist Jean Baudrillard, and Walter Benjamin expressed their concerns about materialism and immaterialism in that they valued the real object, arguing that the unique qualities of it would go missing in a reproduction or simulation. As for example the 3D digital technology is evolving and becoming better in replicating or simulating original objects, worries are that these immaterial objects will converge with the original and manage to convince its audiences and elicit their emotional senses, thus making it difficult for them to perceptually distinguish between

[6] Andrea Witcomb, "The Materiality of Virtual Technologies: A New Approach to Thinking about the Impact of Multimedia in Museums," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 35
[7] Ibid., 35

the material and immaterial objects. If it no longer would be a need for object collections displayed at museums it would of course be of great concern for the institutions.[8] Baudrillard's view on media and its possible impact on undermining what the "true and real" objects represent is that political and historical truth all in all will lose its principle and simply be diminished to information.[9]

As this might be true for objects that are digitised or 3D scanned, it may be different for text based documents that are digitised, as the content of digitised text most often is of more importance than the object itself, for example the paper. This is even more so for a born digital document where a physical carrier does not exist. An exception to that could be considered historical maps, where both the physical carrier and content might be essential.

In comparison to a digital experience of a museum, one of the fundamental effects a museum with objects can have on visitors is according to Gibson the ability to influence alteration. He describes it as a process of transformation for the visitor from unknowing to knowing after having physically visited the museum. The way this can be achieved is by the feeling of being the "other" with the help of empathy and visualisation. So, in order to experience affect, it is for a visitor connected to the emotional reaction experienced by a real object that in its turn creates a more profound understanding of the whole context that the object represents.[10] With the aura, history, provenance and authority the object possesses, proponents for real objects in museums claim this is one essential point that cannot be achieved by digitised replicates.

For the digital object the standpoint of being considered subordinate and judged by already existing values of traditional cultural heritage, like material cultural paradigms, the focus on objects in the museum field and the discourses on heritage maintain the difference between the two.[11] This is of course a situation difficult to challenge.

[8] Fiona Cameron, "Beyond the Cult of the Replicant: Museums and Historical Digital Objects - Traditional Concerns, New Discourses," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 51
[9] Ibid., 50
[10] Ross Gibson, "The Museum as Cultural Laboratory." *The Rebirth of the Museum?* 2004, quoted in Witcomb, "The Materiality of Virtual," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 41.
[11] Cameron, "Beyond the Cult of the Replicant," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 49

Historian Graeme Davison states the dilemma digital cultural heritage is faced with in the following way:

> In its preoccupation with the material remains of the past—''the things'' you ''keep''—it endorses our own materialism; yet in its reverence for what is durable, handmade or unique it also reinforces our underlying distaste for a culture of mass production and planned obsolescence.[12]

The whole concept of ascribing objects as real, authentic with historical provenance, holding authority, and the ability to affect its audience etc. is something that can be traced back to the nineteenth century on thoughts on empiricism and evolution. This has continued to dominate the museum world and culture up until the late twentieth century.[13] With this over a hundred years old longstanding attitude regarding cultural heritage that has continued to dominate the museum world, there can be a certain understanding to the different viewpoints that today exist between the two types of cultural heritage. In Smith's view heritage is:

> […] not necessarily about the stasis of cultural values and meanings, but may equally be about cultural change. It may, for instance, be about reworking the meanings of the past as the cultural, social and political needs of the present change and develop, or it may be about challenging the ways in which groups and communities are perceived and classified by others. Heritage is about negotiation – about using the past, and collective or individual memories, to negotiate new ways of being and expressing identity. In this process heritage objects, sites, places or institutions like museums become cultural tools or props to facilitate this process – but do not themselves stand in for this process or act.[14]

The change that has taken place can partly be attributed to social and political changes that occurred in the 1960's and 1970's with ideas and theories of post-structuralism and post-modernism.[15] In other words, the traditional Western way of having looked upon objects is today considered a social construct in our society, and therefore the criteria that objects hold materiality and represent the true and authentic value is no longer considered an unquestionable truth.

Today, objects that are born digital or have been digitised are permitted to be read and interpreted in newer ways than ever before, and the importance a digital object can hold lies in the audiences' approval of the original object as being authentic. The presence of

[12] Graeme Davison, *The Use and Abuse of Australian History, 2000*, quoted in Cameron, "Beyond the Cult of the Replicant," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 50.
[13] Witcomb, "The Materiality of Virtual," in Cameron and Kenderdne, *Theorizing Digital Cultural Heritage*, 52-53.
[14] Laurajane Smith, introduction to *Uses of Heritage* (London and New York, USA and Canada: Routledge Taylor & Francis Group, 2006), 4, PDF.
[15] Cameron, "Beyond the Cult of the Replicant," in *Theorizing Digital Cultural Heritage.*, 53

digital objects online can act as a way to warrant for the materiality and authenticity of the original objects.[16]

Is there then a real concern for the status of the real objects and all the ascribed criteria they possess in comparison to the new digitised objects? According to Cameron there is a sort of transformation taking place between the meaning of what "real" previously has meant, compared to what it today means when having digital replicas. As real objects are made of some sort of physical material and have a place in history they come to represent an actual existence throughout history, and can therefore act as an evidence of reality for the virtual digital objects.[17]

So, the discussion is about from which perspective one is looking at the objects and the meaning to read from them. From a post-modernist perspective where objects contain many signs, it is more difficult to accept what a modernist perspective can read from an object when compared to a digital virtual perspective.[18] Not to forget is that digital objects in the same way as ordinary objects are constructs, and in so also possess the ability to influence, shape and create our cultural minds.[19]

The role of the museum as mediator between the object and the audience in interpreting and explaining real meanings is today challenged by digital technologies where more than one voice can construe and give sense.[20] The ambivalent standpoint of museums on how to deal with digital cultural heritage can be illustrated by the following quote:

> Museological acceptance is reliant on the need to include some commonly accepted attributes given to analog objects such as materiality, origin, provenance, authorship, and aesthetics that justify their status as historical objects in a digital format, rather than as analogons or information design.[21]

That cultural heritage today has extended to include a new family member in *digital cultural heritage* and been ascribed a certain value in its own right has clearly been demonstrated by UNESCO in its *Charter on the Preservation of the Digital Heritage*, which was presented in October 2003.

[16] Ibid., 54-56
[17] Ibid., 58
[18] Ibid.
[19] Ibid., 69
[20] Ibid., 178
[21] Cameron, "Beyond the Cult of the Replicant," in *Theorizing Digital Cultural Heritage.*, 68

1.5 Methodology

To answers my initial questions in this paper I decided to use a qualitative content analysis as it allowed me to examine what ideas and meanings the authors wanted to convey,[22] and what relevance it would have to the problems of digital preservation and digital cultural heritage.

I began by reading through and observing my sources as a whole in order to get a better understanding of my material. During the reading I defined codes from my sources that were applied to sentences and paragraphs I found interesting. I mainly chose to analyse paragraphs rather than words or short sentences, as I believe it allowed for a better understanding of the whole context of all the material analysed. The defined codes were; social, authenticity, collaboration, economy, standards, heritage, preservation, metadata, co-ordination, policy, digitisation, museum, provenance, long-term, virtual, open, source, digital, emulation, archive, cultural.

Once sentences and paragraphs had been identified and coded I grouped them into themes.[23] In many cases the coded material could belong to more than one theme and I then decided to place it in the theme I considered most relevant to my questions. I applied the same method for each conference proceeding.[24] The themes were; social, authenticity, economy, preservation, metadata, standards, legal, co-operation, co-ordination, policy, technology.

The sentences and paragraphs were then analysed, discussed and interpreted in order to be able to draw conclusions and find answers to the questions I had on the topic of preservation of cultural heritage in digital form.

In the sources I analysed, where applicable, I tried to link relevant information to chapter 1.4 which was used to highlight museums and their role to digital cultural heritage.

[22] Robert Philip Weber, *Basic Content Analysis*, 2nd ed., Sage University Papers Series, no. 07-049 (London, United Kingdom: Sage Publications, 1990), 9, PDF.
[23] Ibid., 15
[24] Ibid.

In the chapter of the National Archives of Australia I exemplified the work of their digital preservation strategy.

1.6 Scope and Limitations

One important matter to remember when discussing *digitisation* and *digital preservation* is that they are not the same. They are closely linked to each other as digitisation is the first step in creating a digital record. How to *preserve* this record is another question. As there are several various digitisation projects taking place all over the world and a need to preserve the material, I decided to frame and limit my research to conference and workshop proceedings presented at three well known and respectable organisations involved with questions on digitisation, digital cultural heritage and digital preservation.

The choice of UNESCO was based on that it is United Nations organisation specialised on education, science and cultures. The European Union was chosen since one of its goals is to promote European cultural heritage and currently supports several various digital cultural projects and programmes. The decision of ICOM/CIDOC was made because it is a worldwide representative organisation for museums working for the protection of natural and cultural heritage.

Since there are many various sources available regarding digitisation and digital preservation, related to the many projects and programmes currently running, I decided to analyse some of the most current conference and workshop proceedings available on the topic. As they are from the years 2011-2014 I believe they present a prevalent view on the situation and indicate where the discussions, possible answers and solutions on digital preservation may lie ahead. The sources consisted of proceedings of one workshop of the EU, conference proceedings of UNESCO and of ICOM/CIDOC.

The source of the EU was based on a report of a workshop within the framework of Horizon 2020 and the European Commission's digital preservation agenda: *Report of the Proceedings of the Workshop – The Future of the Past – Shaping new visions for EU-research in digital preservation.*

UNESCO's source consisted of: *The Conference Proceedings; The Memory of the World in the Digital Age: Digitization and Preservation - An international conference on permanent access to digital documentary heritage.*

ICOM/CIDOC's sources consisted of CIDOC's conference proceedings *Access and Understanding – Networking in the Digital Era*.

In the case of the proceedings workshop of the EU, the source consisted of only one document. For UNESCO and ICOM/CIDOC I had to make a selection of which contributed papers I was going to use.

With ICOM/CIDOC there were 106 papers divided into twelve themes submitted, and with UNESCO there were 110 papers grouped into thirty-three themes. The selection was made by first going through the various themes of the submitted papers.

I decided to limit the themes to the keywords of *digital* and *preservation*, which in the case of ICOM/CIDOC left me with one theme called *Digital Long Term Preservation* and a total of five presentations. It consisted of three papers and two PowerPoint presentations. As one PowerPoint presentation had an accompanying text with information corresponding to each PowerPoint slide, I decided to include it and analyse the accompanying text. As the other PowerPoint presentation only consisted of very short sentences and single words, I decided it would not be enough to analyse.

In addition, one of the papers I was unable to obtain even though I contacted the responsible person for the conference more than once and also wrote to the authors of the paper without receiving any answer, leaving me with a total of three presentations.

With UNESCO I ended up with five themes; *The Role of Culture in Digitization and Digital Preservation*; *Collaboration in Digital Preservation or Lack Thereof: What Works; Is A New Legal Framework Required for Digital Preservation or Will Policy Do?*; *Digitization and Digital Preservation Experiences in a Developing Country Perspective*, and *Metadata and Formats for Digitization and Digital Preservation*, resulting in a total number of nineteen papers. In order to achieve a more balanced analysis in comparison to the three presentations of ICOM/CIDOC and the one paper of

the EU, I decided that out of the five groups choose one paper per group which had the word *digital preservation* in its title to be analysed, thus leaving me with a total of five papers.

2. BACKGROUND

In this chapter I begin by presenting definitions of cultural heritage and digital cultural heritage before moving on to digitisation of cultural heritage which is important in order to understand the impact it has on society. Following that, in cultural heritage versus digital cultural heritage in museums, I present a background to some of the challenges museums have gone through in the last decades, including the view on *digital cultural heritage*. After that I discuss digital preservation, which includes sections on preservation methods, the OAIS framework, metadata, open-source and digital preservation policy, in order to understand the complexity of preservation in digital form. Finally, I conclude the chapter with the example of National Archives of Australia and their work with open-source as a digital preservation method.

2.1 Definitions of Cultural Heritage and Digital Cultural Heritage

How we determine what cultural heritage is or not is, and what should be included or excluded, are questions that might prove difficult to answer. A quote from Erik Wegraeus, former Director-General of the National Heritage Board in Sweden, can guide us:

> Each age forms its own opinion of the significance of the cultural heritage and of those aspects of it which are particularly valuable. Perceptions of the cultural heritage are influenced by such factors as the pace and direction of social change, the social and ideological climate of discussion and the findings of research.[25]

The term cultural heritage has traditionally been considered difficult and complex to define and often been related to, for example, stories, physical objects like monuments etc. which one generation passes on to the next. This heritage has been considered something which has held essential cultural, political or economic value worth preserving.[26] Smith says that heritage from a Western point of view:

> […] tends to emphasize the material basis of heritage, and attributes an inherent cultural value or significance to these things. Furthermore, the sense of gravitas given to these values is also often directly linked to the age, monumentality and/or aesthetics of a place. The physicality of the Western idea of heritage means that 'heritage' can be mapped, studied, managed, preserved and/or conserved, and its protection may be the subject of national legislation and international agreements, conventions and charters. However, heritage is heritage *because* it is subjected to the management and preservation/conservation process, not because it simply '*is*'.[27]

[25] Erik Wegraeus, "From Ancient Monuments to Cultural Environment," in *The Cultural Heritage in Sweden - Preserving the Past for Posterity* (Stockholm, Sweden: Svenska Institutet, 1998), 76
[26] Jenny Kidd, "Performing the Knowing Archive: Heritage Performance and Authenticity," *International Journal of Heritage Studies* 17, no. 1 (November 25, 2010): 24, PDF.
[27] Smith, introduction to *Uses of Heritage*, 3.

When discussing cultural heritage the definition and view of the term by the three organisations examined in this paper are described the following way; UNESCO covers three main terms which are known as; cultural heritage, natural heritage and heritage in the event of armed conflict. Cultural heritage itself consists of tangible and intangible cultural heritage, where tangible cultural heritage includes movable, immovable and underwater heritage. Movable cultural heritage includes anything that we can bring with us, in contrast to immovable cultural heritage which is represented by for example archaeological sites. Underwater cultural heritage is for example shipwrecks and ruins under water. Intangible cultural heritage consists of rituals, performing arts and oral traditions.[28]

EU's view on cultural heritage is described, in the European agenda for culture, by the European Commission in the following way;

> This agenda is articulated around three main objectives, with a clear and vital role for cultural heritage: promoting cultural diversity and intercultural dialogue, promoting culture as a catalyst for creativity in the framework of the Lisbon Strategy for growth and jobs promoting culture as a vital element in EU external relations.[29]

For ICOM/CIDOC, who according to Article 1 in their statutes formally upholds "relations with […] UNESCO and having a consultative status with the United Nations Economic and Social Council"[30], their view on cultural heritage can be read in their Mission and Purpose:

> ICOM is the international organisation of museums and museum professionals which is committed to the conservation, continuation and communication to society of the world's natural and cultural heritage, present and future, tangible and intangible.[31]

When looking at the definition of *digital cultural heritage* it is according to UNESCO's Charter on the Preservation of Digital Cultural Heritage defined as:

> The digital heritage consists of unique resources of human knowledge and expression. It embraces cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources. Where resources are "born digital", there is no other format but the digital object.[32]

[28] UNESCO, "What is meant by 'cultural heritage'?," UNESCO, last modified June 9, 2014, accessed June 9, 2014, http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/.
[29] European Commission, "Preserving Our Heritage, Improving Our Environment - Volume I 20 Years of EU Research into Cultural Heritage," *Research*eu*, 2009, 5, PDF.
[30] "ICOM Statutes," ICOM Statutes, last modified August 24, 2007, accessed June 9, 2014, http://icom.museum/fileadmin/user_upload/pdf/Statuts/statutes_eng.pdf.
[31] ICOM, "ICOM Statutes."
[32] UNESCO, "Charter on the Preservation of the Digital Heritage," last modified October 17, 2003, PDF.

EU's view on *digital cultural heritage*, here represented by the European Commission, states the following:

> The Digital Agenda for Europe seeks to optimise the benefits of information technologies for economic growth, job creation and the quality of life of European citizens, as part of the Europe 2020 strategy. The digitisation and preservation of Europe's cultural memory which includes print (books, journals, newspapers), photographs, museum objects, archival documents, sound and audiovisual material, monuments and archaeological sites (hereinafter 'cultural material') is one of the key areas tackled by the Digital Agenda.[33]

When it concerns ICOM/CIDOC's policy on *digital cultural heritage* I was not able to find any specific information or documentation on their view on the topic. But as referred to above, regarding ICOM's relationship with UNESCO concerning cultural heritage, my assumption is that their view on digital cultural heritage also adheres to UNESCO's view.

2.2 Digitisation of Cultural Heritage

The heritage of human beings history can take advantage of digital technology to convey information of our past. It can be used in a variety of fields today and we naturally find it all around us, ranging from entertainment, social media, art, visualisations and as digital substitutes.[34]

As the name digital substitute insinuates, it substitutes for something else, in this case the real world. The advantage of using digital substitutes is that it can, amongst others, be used in academia and by scholars to perform various research works on objects without the need of physical examinations, something that can be very beneficial in the case of objects and documents that are very old and fragile.[35]

Empirical provenance is of great concern when it comes to digital cultural heritage. For example, a digital photograph created by a digital device is born digital and has no original to be compared to. This is of course different from the objects we decide to manually digitise and it is of greatest significance that the digitised objects can be trusted. As in the material world of objects, for any digitised object there is a need to

[33] European Commission, "Commission Recommendation of 27 October 2011 on the Digitisation and Online Accessibility of Cultural Material and Digital Preservation," *Official Journal of the European Union*, no. 283 (October 29, 2011): 39, PDF.
[34] Mark Mudge, Michael Ashley, and Carla Schroer, "A Digital Future for Cultural Heritage" (contribution to "XXI International CIPA Symposium,"conducted at CIPA, Athens, Greece, October 1, 2007), 1
[35] Ibid., 2

record every step that has been taken from the initial moment of generating the data leading up to the created digital final substitute. This process helps create a history and representation of the digitised objects in a digitised world.[36] By doing this, we also create a very important link between the historical object's original past and its new virtual, digital substitute.

ICOM has adopted a reference model where the work of CIDOC is to inform and keep members of museums, libraries and specialists in information-management up-to-date on the latest developments in the fields of data standards and documentation regarding cultural heritage.[37] The Conceptual Reference Model (CRM), which is an ISO-standard (ISO 21127:2006), was adopted in 2006 and the aim of the model is to aid cultural heritage documentation in establishing a formal structure and definitions that can be used to understand concepts and relationships. With this, the hope is to make it easier amongst memory institutions to work within a shared extensible framework and use it as a language for all parties involved.[38]

As many historical objects and artefacts are stored in depots away from the museums and sometimes not put on public display, it not only makes it inaccessible to the public in general, but also to professionals in the fields of for example history, archaeology and the arts. One benefit of digitising cultural heritage is that it can remove physical boundaries of access as it can be made available to anyone to look at, explore and research.[39]

Museums that digitise their collections also contribute in strengthening its profile, and as we today live in a digital era and visitors come from all around the globe to get

[36] Ibid.
[37] "CIDOC - Documentation International Committee for Documentation," ICOM The World Museum Community, accessed May 15, 2014, http://icom.museum/the-committees/international-committees/international-committee/international-committee-for-documentation/.
[38] "What is the CIDOC CRM," The CIDOC Conceptual Reference Model, accessed May 15, 2014, http://www.cidoc-crm.org/index.html.
[39] René Berndt et al., "A Publishing Workflow for Cultural Heritage Artifacts from 3D-Reconstruction to Internet Presentation," in *Digital Heritage - Third International Conference, EuroMed 2010 Lemessos, Cyprus, November 8-13, 2010 Proceedings*, ed. Marinos Ioannides, et al. (Berlin Heidelberg, Germany: Springer-Verlag, 2010), 166

access to collections through a virtual visit, this can be positive for both museums and visitors.[40]

Other factors to consider why there might be a need for digitisation of cultural heritage are for example countries affected by war or unrest, and where cultural heritage can be used as a political and religious weapon in order to destroy the identity of a group. Further, the lack of financial means and skills in developing countries can also lead to negligence of care of valuable cultural heritage.[41] Another aspect to consider is the tourism industry where earlier uncontrolled, and today even controlled, access puts strain on cultural heritage sites. In some cases, areas on a site are not accessible due to restoration work, and at other times, time is a factor that limits the full experience for the visitor. A digitised virtual version of objects on a site made accessible online could complement the visit. Not to forget the advantage for people suffering from disabilities and who physically cannot visit.[42]

To know what type of audience one is targeting is a point Bianchi means is very crucial. Because no matter how well done and accurate a digital version of an original object has been made, it will never fully substitute the original. He talks about the digital versions as interpretations of material, tangible objects. When audiences experience a digital version they are not presented with a true, real artefact but with a mediated version, and the success of this interpreted digital version depends on the technical quality and the ability to know and understand what the audiences are expecting.[43]

As our society has become digital and allows visitors from all over the world of all ages and social strata it can be difficult to know one's audiences. In a digital environment there is more than one possibility to create one's own exhibition in a way that is personally suitable. For example can a visitor decide to arrange objects according to certain describing keywords, objects can be sorted according to year, country, theme or

[40] Alexia Dini Kounoudes, Petros Artemi, and Marios Zervas, "Ktisis: Building an Open Access Institutional and Cultural Repository," in *Digital Heritage - Third International Conference, EuroMed 2010 Lemessos, Cyprus, November 8-13, 2010 Proceedings*, ed. Marinos Ioannides, et al. (Berlin Heidelberg, Germany: Springer-Verlag, 2010), 504
[41] Cristiano Bianchi, making online monuments more accessible through interface design in *Digital Heritage Applying Digital Imaging to Cultural Heritage*, ed. Lindsay MacDonald (Oxford, United Kingdom: Elsvier, 2006), 449
[42] Ibid., 450
[43] Ibid.

social status. This allows for making visual examinations and comparisons about, for example, people, societies and cultures much easier compared to traditional museum exhibitions.[44] For a digital generation of visitors this kind of ability to easily move in time and space is becoming increasingly important and attractive.

Visiting cultural institutions where digital substitutes do not exist, visitors have been told by curators and professionals what objects are and represent. This way of transmitting knowledge is what visitors have been accustomed to, but the traditional way of conveying information and understanding about content in a specific context made through an exhibition, can be done differently. In a digital virtual environment can for example several parts of a museum be accessed at the same time and thus combining elements from various exhibitions, and by doing so, contributing to the enhancement of understanding on a specific topic.[45]

When cultural heritage becomes digitised it does not automatically mean that it is accessible for the whole world on the Internet. It is accessible for those who speak and read the language or languages of the cultural institution's homepage. As much as technical solutions and compatibility with various digital platforms is essential, so is the language of communication. Today, English is one of the most used languages on the Internet, but even if many people understand the language it is necessary for the creators of digital cultural heritage websites to be aware of a style that is neither too technical, nor too academic in order to reach a broader audience.[46]

2.3 Cultural Heritage versus Digital Cultural Heritage in Museums

Taking advantage of technological developments is something that is being expected more and more by today's visitors of memory institutions and especially by future generations to come. Today's society with Internet and digitisation has come to pose challenges to memory institutions, some more affected than others. The traditional term *cultural heritage* has today a new family member in *digital cultural heritage*. This new kinship has turned out to be not completely unproblematic. In contrast to some other memory institutions, museums have a somewhat ambivalent relationship to digital

[44] Ibid., 451
[45] Ibid., 452
[46] Ibid., 456

cultural heritage. According to some, cultural heritage represents *the real* and digital cultural heritage does not fully live up to that criterion.

The relationship between museums and their audiences has for the past fifty years experienced a great change. In the past, the relationship between the museum and their visitors could have been regarded as one-dimensional and modest. At this time the museum was seen as an undisputed absolute expert in its field. The museum's employees considered their visitors as a mirror image of themselves, and that the visitors were knowledgeable enough to understand the real and symbolic meanings of the museum collections on display, as well as the importance it held for society. Museums predicted that their audience would understand the definitions and rules by which museum collections were collected and should be read.[47]

In the last circa thirty years there has been a change for some museums realising that their audiences are not homogenous. On the contrary, they consist of several different groups in society and these visitors are eager to express what their needs are, despite not necessarily having a need to visit a museum.[48] Digital cultural heritage might be a way to accommodate these needs as digital objects can be accessed in various ways from different platforms, like for example computers, smartphones and tablets.

In the changing world of the twenty-first century with rapid changes in technology and the way we communicate, museums can play a valuable role in society through promotion of social change. This can for example be achieved through active learning. As museums are powerful social constructs they can take on the role as social agents in people's life and not stay in the periphery.[49] For this to take place, museums would need to re-appraise their role, mission and goal, as well as what functions and strategies they would need to implement in order to mirror the anticipations of a world in change.[50]

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[47] John Reeve and Vicky Woollard, "Influences on Museum Practice," in *The Responsive Museum: Working with Audiences in the Twenty-First Century*, ed. Caroline Lang, John Reeve, and Vicky Woollard (Hampshire, England: Ashgate Publishing, 2006), 5

[48] Ibid.

[49] Chris Torch, "European Museums and Interculture: Responding to Challenges in a Globalized World," *Council of Europe*, accessed March 18, 2014, http://www.coe.int/t/dg4/cultureheritage/culture/Cities/Newsletter/newsletter13/museumsTorch_en.pdf

[50] Emmanuel N. Arinze, "The Role of the Museum in Society" (lecture, National Museum, Georgetown, Guyana, May 17, 1999). 1-2

2.4 Digital Preservation

To get a better understanding of what the term digital preservation means let us begin by looking at definitions made by some authors and papers, as how to address it will vary depending on who is defining it. UNESCO defines it the following way:

> Digital preservation is used to describe the processes involved in maintaining information and other kinds of heritage that exist in a digital form. In these Guidelines, it does not refer to the use of digital imaging or capture techniques to make copies of non-digital items, even if that is done for preservation purposes. Of course, digital copying (also known as digitisation, or digitalisation), may well produce digital heritage materials needing to be preserved.[51]

Jan-Henry M. Gladney refers to long-term digital preservation and states that it is "processes and technology for mitigating the deleterious effects of technological obsolescence and fading human recall effects which are usually apparent only some years after a digital object was created and collected."[52] A couple of years after UNESCO's definition, we can see that Gladney's definition has added the word *long-term* to it.

Although technological developments have advanced and our understanding of the complex situation of digitised files and future access to them we can still today, ten years after UNESCO's definition, find that some perceive that *digitisation* is equal to *digital preservation*. Zahidi, Lim and Woods state that; "Digitisation of cultural heritage is important as one of the ways of digital preservation."[53], and Lu and Pan refers to it as; "Digitalization can store the heritage information in digital format therefore prolonging the "life of the heritage items."[54]

As more material is digitised and we continuously create new born-digital data day by day there are new factors to take into consideration when digital data needs to be preserved. The significance of digitisation is by Singh defined as; "Digitization means acquiring, converting, storing and providing information in a computer format that is

[51] UNESCO, "Guidelines for the Preservation of Digital Heritage," UNESCO, last modified 2003, accessed August 7, 2014, http://unesdoc.unesco.org/images/0013/001300/130071e.pdf.
[52] Jan-Henry M. Gladney, "Why We Need Long-Term Digital Preservation," in *Preserving Digital Information* (Berlin Heidelberg: Springer-Verlag, 2007), 4.
[53] Zaihasriah Zahidi, Yan Peng Lim, and Peter Charles Woods, "User Experience for Digitisation and Preservation of Cultural Heritage" (paper presented at 2013 International Conference on Informatics and Creative Multimedia, 2013), 13.
[54] Dongming Lu and Yunhe Pan, *Digital Preservation for Heritages: Technologies and Applications* (Dordrecht, London, New York, Netherlands, United Kingdom, USA: Springer Heidelberg, 2010), v.

standardized, organised and available on demand from common system."[55] Other views describe the importance of digitisation as; "[…] it is important for us to build a network based digital museum to upgrade and digitalize our college and national museums for the sake of resource sharing and protection as well".[56], and "The digitalization of these treasures opens up the possibility of using image processing and analysis and computer graphics techniques to preserve this heritage for future generations and to augment it with accessory information or with new possibilities for its enjoyment and use."[57] These types of definitions are not unproblematic as digitisation itself does not automatically preserve the files and grant us future access.

Regarding analogue material, digitisation is a first step to undertake in order to achieve digital files which can be shared, accessed and hopefully well protected for a long time, though it is not the answer to digital preservation of digital material. In addition, the traditional methods applied by memory institutions to preserve analogue material, will not be sufficient enough for digital data.

Digital preservation is by Singh described as; "Digital preservation is the management of digital information over time. It takes the form of processes and activities that ensure continued access to information and all kinds of records, both scientific and cultural heritage, that exist in digital form."[58] This definition is also shared by Evens and Hauttekeete who state that; "Digital preservation should be understood as a set of management processes and activities that ensures permanent access to digital information, including scientific and cultural heritages."[59] That there exists a bit of confusion between the definition of digital preservation and digitisation is addressed by Conway as:

> Digitization for preservation creates valuable new digital products, whereas digital preservation protects the value of those products, regardless of whether the original source is a tangible artefact or data that were born and live digitally. Digitization for

[55] Anil Singh, "Digital Preservation of Cultural Heritage Resources and Manuscripts: An Indian Government Initiative," *IFLA Journal* 38, no. 289 (December 14, 2012): 290.
[56] Mingquan Zhou, Guohua Geng, and Zhongke Wu, *Digital Preservation Technology for Cultural Heritage* (New York, Dordrecht, London, USA, Netherlands, United Kingdom: Springer Heidelberg, 2012), 208.
[57] Filippo Stanco, Sebastiano Battiato, and Giovanni Gallo, *Digital Imaging for Cultural Heritage Preservation: Analysis, Restoration, and Reconstruction of Ancient Artworks* (Florida, USA: Taylor & Francis Group, 2011), vii.
[58] Singh, "Digital Preservation of Cultural," 289.
[59] Tom Evens and Laurence Hauttekeete, "Challenges of Digital Preservation for Cultural Heritage Institutions," *Journal of Librarianship and Information Science* 43, no. 157 (May 24, 2011): 158, PDF.

> preservation and digital preservation are intimately related, but the underlying standards, processes, technologies, costs, and organizational challenges are quite distinct.[60]

When discussing digital preservation, Harvey refers to a need of change of paradigms concerning heritage institutions and preservation since current techniques are not sufficient enough regarding digital material. Earlier methods of preservation pose new challenges in that material in digital format is hard and software dependant in order to be accessed, and that these are of complex nature, and in addition, that digital material is in a constant need of being cared for. Previous models that have been developed for the past centuries of preservation techniques have mainly been collection-based. Though, this is changing in importance and decreasing, and now access to information in digital formats is increasing. In an environment of digital records there is a transformation process taking place in that a physical object as holder of information is not the essential part to preserve, but the *information itself* stored on a physical object, like for example a USB stick, CD or external hard drive.[61]

Today, in a world made up of both physical and digital objects there is clearly a need to agree on what is meant with digital preservation and how to address it.

The difference between traditional and digital preservation techniques and the consequences it can have can be described by the term *benign neglect*, a term used in what Harvey refers to as the pre-paradigm of preservation. The activity mainly concerns artefacts made of paper, which if not being handled too much would not degrade as quickly as otherwise. This attitude stands in sharp contrast on how to preserve digital files, as it for certain would be negative due to the rapid changes in technology.[62]

That digital preservation is proving to be problematic and that the answer to the problem does not simply lie with digitisation has become obvious. In a report from SHAMAN (Sustaining Heritage Access through Multivalent ArchiviNG), it is summarized as:

> Digital preservation is an issue caused by the fact that IT solutions are inherently short-lived and ever-changing, causing organizational knowledge to be trapped and confined in

[60] Paul Conway, "Preservation in the Age of Google: Digitization, Digital Preservation, and Dilemmas," *The Library Quarterly* 80, no. 1 (January 2010): 64, PDF.
[61] Ross Harvey, *Preserving Digital Materials*, 2nd ed. (Berlin/Boston, Germany/USA: Walter de Gruyter GmbH & Co. KG, 2012), 3ff.
[62] Ibid., 8

> obsolete or proprietary formats, in a context where IT problems and solutions intersect with organizational policies and missions. The complexity of DP increases with the fact that each organizational scenario contains different types of digital objects, each having its own specific requirements.[63]

One example of this is what Stanco, Battiato, and Gallo make us aware of. Though studies on how to preserve everyday media largely has been undertaken, there is a gap in the studies on how to preserve 3D material for the future. The problem lies in that established routines on how to handle 3D scans are lacking and that the scans often are encoded into file formats that are closed, which limit future access to them.[64]

As costs to digitise cultural heritage can be expensive and life expectancy and accessibility to digital files may be short, digital preservation can be divided into two parts. The first part consists of the digital technology needed to create digital files, and the second part is the ongoing work of making sure that the digital files, whether the material is digitised or born digital, will be accessible for the future on devices that might look and act differently from what we today are accustomed to.[65] This is work that requires constant monitoring and upgrading of soft and hardware. When it concerns preservation of digital objects we are faced with several steps of the preservation process that are interlinked and important.

2.4.1 Migration and Emulation

When considering preservation of digital files for a long time there are two methods that often are referred to, they are known as migration and emulation. Migration can be grouped into two subgroups where the differences lie in whether the bit sequences of a digital file will be altered or not. The two operations that do not modify the bit sequences are known as refreshment and replication. Refreshment is by Giaretta described as: "[…] a media instance, holding one or more AIPs[66] or parts of AIPs, is replaced by a media instance of the same type by copying the bits on the medium used to hold AIPs […]", and replication as: "[…] where there is no change to the Packaging Information, the Content Information and the PDI[67]. The bits used to convey these information objects are preserved in the transfer to the same or new media-type

[63] Gonçalo Antunes et al., *SHAMAN Reference Architecture* (SHAMAN, 2012), 13, PDF.
[64] Stanco, Battiato, and Gallo, *Digital Imaging for Cultural*, 93.
[65] Stijn Hoorens et al., *Addressing the Uncertain Future of Preserving the Past Towards a Robust Strategy for Digital Archiving and Preservation* (Santa Monica, US: RAND, 2007), 1.
[66] AIP stands for Archival Information Package, authors comment.
[67] PDI stands for Preservation Description Information, authors comment.

instance."[68] These explanations can seem difficult to understand as they refer to the underlying parts that make up a digital file.

In other words, for refreshment; by using the same type of media format that the original resides on and making an identical copy of it on to the new media, one does not face the problem of altering the underlying structures of the digital material, but as technological advancements progress there will eventually be a problem in the future to continue using the original media formats, as well as the hardware to access it.

With the help of using Borghoff et al. the following explanation of what replication involves may become a bit clearer:

> If data are copied onto media of a different kind (for instance, from a tape to a DVD), the internal structure of the new media will often differ considerably from that of the original. Whereas a magnetic tape is *physically* organized into sequence of blocks providing sequential access to bytes streams, an optical disc is organized into sectors and blocks that can be accessed directly. […] The […] strategy, which copies data between media that are of different physical, but of the same logical structure, is called *replication*.[69]

The other two migration strategies that exist and which do alter the underlying structures of digital material are known as repackaging and transformation. In the case of repackaging, the bits that make up a digital file will be affected if there is any change to the contents, composition or the location of an AIP.[70] Transformation is according to Giaretta actually a term that in most cases when discussing migration rather should be used. This is because what actually is referred to is a transformation in the digital encoding of files. The change that takes place in a digital file during transformation involves alteration of either the Content Information or PDI.[71]

The use of migration as a strategy for preservation of digital material is not as straightforward as it first may seem, as there are more than one way of doing it and there is a risk of alteration in the process.

[68] David Giaretta, *Advanced Digital Preservation* (Berlin, Germany: Springer-Verlag, 2011), 200.
[69] Uwe M. Borghoff et al., *Long-Term Preservation of Digital Documents: Principles and Practices* (Heidelberg, Germany: dpunkt.verlag GmbH, 2003), 38f.
[70] Ibid., 52
[71] Giaretta, *Advanced Digital Preservation*, 201.

Migration is by UNESCO explained as the process where digital data has to be transferred from one storage carrier to a new type of carrier with the possibility along the process that it becomes transformed in some way. This can for example include the coding of the digital material itself and/or even the metadata used to define the object and its creation process.[72] This does of course raise questions on how reliable migration seems to be. As with any type of data the need for authenticity is essential, we would of course expect that what we now preserve remains the same in the future and has not been altered with in any way.

Ross confirms that migration is problematic in the following way:

> Because […] migration replace obsolete digital media with current media, the artefact itself, because it is replaced, cannot demonstrate qualities such as originality, authenticity or fixity; other mechanisms are used to demonstrate these evidentiary qualities. This is a major change from pre-digital paradigm thinking, and we are only slowly changing our professional mindsets to accommodate the necessary changes in practice.[73]

As outlined above we can see that the strategy of migration can be complicated and has its limits. An alternative method for preservation has been the use of emulation.

Emulation is the process of imitating or copying the actions of someone else or something else. In the case for preservation its role is to emulate past technical hardware and software solutions in order to run in a modern environment, and thus leave the original digital files intact. Evens and Hauttekeete describe emulation in the following way: "[…] the original object and its original look and feel are preserved."[74] This sounds very promising and easy to achieve, the question is whether it really is so.

When discussing emulation it can be grouped into five types, which are Hardware Simulation, Instruction Emulation, Virtualisation, Binary Translation and Virtual Machines. In the case of Hardware Simulation the idea is to provide future computer hardware with the exact performance of how old computer environments used to run. In the case of this method Giaretta reminds us that this will create emulators that are slow and difficult to achieve due to the way they are built, where parts of the system are being recreated using empirical and mathematical models.[75]

[72] UNESCO, "Guidelines for the Preservation," UNESCO
[73] Harvey, *Preserving Digital Materials*, 54
[74] Evens and Hauttekeete, "Challenges of Digital Preservation," 158
[75] Giaretta, *Advanced Digital Preservation*, 127

With Instruction Emulation there is no need to rebuild the complete source code of the computer system. Instead, instructions for the central processing unit are done through software which, for example, allows an operating system to run on the newer hardware.[76] One example of this would be the ability to run an old Microsoft Word document made for Windows 3.1 from the early 1990's on a Macintosh computer of today.

In another form of emulation where everything is emulated, except the central processing unit, Virtualisation of various software and operating systems can take place provided that they are built for the specific processor of the computer.[77]

Binary Translation takes place when a set of instructions for a software program is being translated into another one, which results in a new software which then can be used on another computer using these new instructions. Virtual Machines are by Giaretta explained in the following way: "They define a hardware independent instruction set […] which is compiled […] to the instruction set of the host system. […] The VM must be re-written for, or ported to, the host system."[78]

The above information on the various types of emulation processes is very technical in nature and the reason for the brief overview on how they work is to provide for a better understanding of the complexity of emulation. Not only is it technically complicated, it will also require specialised knowledge in order to build the emulated environment, which will be expensive.[79] In addition, as emulation has a tendency to slow down performance on the computer it is applied to there will be a need for more powerful computers in the future in order to run the emulators satisfactorily.[80] Further critiques against the use of emulation are amongst others; that the technology so far has not been tested enough in reality to a satisfactory level; that it cannot live up to what is asserted of it; and that sufficient documentation on soft- and hardware is not adequate enough, which might discourage the development of emulators.[81]

[76] Ibid.
[77] Ibid., 128
[78] Ibid., 129
[79] UNESCO, "Guidelines for the Preservation," UNESCO.
[80] Borghoff et al., *Long-Term Preservation of Digital*, 58
[81] Harvey, *Preserving Digital Materials*, 136

Another drawback of the emulation approach is that future computer users, who then will be used to a computer milieu that might differ considerably compared to today, would have to re-learn how to interact with old emulated computer environments. Harvey points to that if emulation as a method for long-term preservation is to be used, it should be based on open-source code and follow the technique of best practice with proper documentation.[82]

In 2009, a survey made by Planets (Preservation and Long-term Access through Networked Services), an EU-funded project, showed that the interest in emulation as preservation strategy was considerable lower compared to migration. It concluded that:

> Whether this lack of interest is because emulation is not yet seen as a practical preservation solution, due to the poor usability and accessibility of emulators and the complexity and perceived cost of implementing an emulation solution is unclear. However, it points to the need for education about the role of emulation as a preservation strategy.[83]

One of the advantages that emulation brings with it is that if a hardware environment has been satisfactorily emulated, it will allow the user to run all the various types of software that originally were capable of being run on that machine, including any original operating system that were designed for it.[84]

Which one of the two strategies of migration and emulation to use depends on the user, as each one of the methods can have its own advantages and disadvantages. Harvey states that:

> The battle lines were drawn in the 1990's between migration and emulation as the preservation strategy most likely to succeed. In the event neither has dominated, as we learn to place less trust in a single-strategy salvation and to develop ways of working and thinking that accommodate several approaches simultaneously.[85]

One problem in general concerning migration and possibly emulation as well is the question regarding copyright. This mainly concerns material that is not in the public domain. In America, the Digital Millennium Copyright Act (DMCA) from 1998 enforces certain restrictions on digital material concerning compilation, copying and long-term retention, including questions regarding any change of formats. Kahn

[82] Ibid.
[83] Planets (Preservation and Long-term Access through Networked Services), *The Digital Divide: Assessing Organisations' Preparations for Digital Preservation*, A Planets White Paper (Planets-project, 2010), 7, PDF.
[84] Giaretta, *Advanced Digital Preservation*, 124
[85] Harvey, *Preserving Digital Materials*, 134

reminds us that it is essential to keep in mind that with any type of digitisation project undertaken, the need to make sure that legal rights concerning intellectual property and copyright issues have been settled beforehand is crucial.[86]

Four alternatives to consider in order to avoid too many problems are to; preserve material where there is no longer any existing copyright attached to it; take over ownership of the material from its creators; get a license from the owners which allows for preservation; or following the existing laws in the country where preservation is to take place.[87] The last point will of course be different for each country in regards to various policies for archives, libraries and museums and their role on preservation.

These questions are complicated, especially with concerns to the migration method which inevitably to some extent in the future most likely will alter digital material. The meaning and representation of an original file, whether it may be a homepage, an artistic piece of work like a photograph or financial transactions, which might be lost through modification is something we today only can speculate about.

2.4.2 Open Archival Information System (OAIS)

In order to facilitate for institutions that need to preserve and achieve some type of uniformity and design for the material that is being preserved, a framework called the OAIS Reference Model has been established with the aim to guide and establish a common language.[88] It is as Kahn describes it: "a structural approach to archives enabling interoperability between programs, platforms, generations, systems, etc."[89]

OAIS is an ISO 14721 certified archive system which serves as a platform for exchange of information and ideas relating to digital long-term preservation, terms and key questions.[90] Giaretta defines OAIS as: "[…] an archive, consisting of an organization, which may be part of a larger organization, of people and systems that has accepted the responsibility to preserve information and make it available for a Designated

[86] Miriam B. Kahn, *Protecting Your Library's Digital Sources: The Essential Guide to Planning and Preservation* (Chicago, United States: American Library Association, 2004), 47
[87] Giaretta, *Advanced Digital Preservation*, 187
[88] Antunes et al., *SHAMAN Reference Architecture*, 14
[89] Kahn, *Protecting Your Library's Digital*, 52
[90] Borghoff et al., *Long-Term Preservation of Digital*, 21

Community."[91] The word open in the name of the OAIS refers to that the archive has taking an approach to be developed in open forums.[92]

In order for an organisation to be considered an OAIS repository there are certain responsibilities that need to be fulfilled. The following five points must according to Gladney be adhered to:

- negotiate for and accept content from information producers;
- obtain sufficient content control, both legal and technical, to ensure long-term preservation;
- determine which people constitute the *designated community* for which its content should be made understandable and particularly helpful;
- follow documented policies and procedures for preserving the content against all reasonable contingencies, and for enabling its dissemination as authenticated copies of the original, or as traceable to the original;
  and
- make the preserved information available to the designated community, and possibly more broadly.[93]

The importance the OAIS model plays in digital long-term preservation is acknowledged by UNESCO in that it: "[…] is the most successful attempt to define both a conceptual model for managing digital materials of enduring value, and a vocabulary with which to discuss it."[94]

One important part of the OAIS Reference Model is made up of what is referred to as the Packaging Information, this in its turn consist of two parts, Content Information, and Preservation Description Information. This part of information is vital to us since a digital object does not only consist of what we actually are trying to preserve, for example a text document, or an audio or video file. It lets us know what it is that we are preserving, how it should be preserved and in which environment it was created, this is also known as metadata, an indispensable part of OAIS.[95]

With regards to a digital file and its provenance and authenticity, the OAIS Reference Model can through the Content Information and Preservation Description Information provide for that.

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[91] Giaretta, *Advanced Digital Preservation*, 47
[92] Brian F. Lavoie, *The Open Archival Information System Reference Model: Introductory Guide*, DPC Technology Watch Series Report 04-01 (Dublin, USA: OCLC Online Computer Library Center, Inc. and Digital Preservation Coalition, 2004), 3, PDF.
[93] Gladney, "Why We Need Long-Term," in *Preserving Digital Information*, 14
[94] UNESCO, "Guidelines for the Preservation," UNESCO.
[95] Harvey, *Preserving Digital Materials*, 82

The Preservation Description Information itself is made up by four parts known as Reference Information, Context Information, Provenance Information and Fixity Information. The role of the Provenance Information is that it, as Lavoie points out: ”[…] documents the history of the Content Information, including its creation, any alterations to its content or format over time, its chain of custody, any actions (such as media refreshment or migration) taken to preserve the Content Information.”[96] One question that comes to mind is how far back the archive is responsible for the provenance. Giaretta clarifies that: “[…] The archive is responsible for creating and preserving Provenance Information from the point of Ingest, however earlier Provenance Information should be provided by the Producer. Provenance Information adds to the evidence to support Authenticity.”[97]

When it concerns authenticity it is defined as: “the degree to which a person (or system) may regard an object as what it is purported to be. The degree of Authenticity is judged on the basis of evidence.”[98] For the Fixity Information, its role is that it: “validates the authenticity or integrity of the Content Information: for example, a checksum, a digital signature, or a digital watermark.”[99] The significance of authenticity and provenance for digital files cannot be underestimated.

Nevertheless, there are threats that exist to authenticity and they are described by UNESCO in the following way when it concerns identity: “Loss of certainty about how an object is distinguished from other objects damages authenticity. This may result from confusion in identifying data, changes to identifiers, or failure to document the relationships between different versions or copies.”[100] And further to the integrity of the digital material as: “Changes to the content of the object itself also potentially damage authenticity. Most such changes stem from threats to the object at a data level.”[101]

Giaretta makes us aware that: “The integrity of a resource refers to its wholeness. A resource has integrity when it is complete and uncorrupted in all its essential

[96] Lavoie, *The Open Archival Information*, 13
[97] Giaretta, *Advanced Digital Preservation*, 205
[98] Ibid.
[99] Lavoie, *The Open Archival Information*, 13
[100] UNESCO, "Guidelines for the Preservation," UNESCO.
[101] Ibid.

respects."[102] UNESCO further lists out seven points that are considered threats to data integrity. They are:

- "Natural" generation of errors that arise in digital storage systems
- Breakdown of carriers. Most carrier media have a reasonably short useable life before deteriorating to the point of unreliability for data storage
- Malicious attack, which may come from system hackers, viruses, staff or outside intruders interacting with the storage system
- Collateral damage from malicious acts such as terrorist attacks, acts of war or civil unrest affecting buildings or power supplies
- Inadvertent acts by staff or visitors such as turning off power, throwing out disks or tapes, or reformatting storage devices
- "Natural" disasters such as fire, flood, or building collapse
- Business failure[103]

That the OAIS Reference Model plays an important role in digital preservation is clear. Although the views on the OAIS Reference Model in general are positive, it has by Jeffrey been criticised for not providing with enough guidance in the everyday work with it.[104] And Giaretta reminds us that even if the goal is to achieve one hundred percent authenticity for digital objects, and a certain level of it is provided with the OAIS Reference Model, it most likely cannot be achieved and guaranteed. This has to do with the bits that make up any digital file: "[…] one cannot really ensure the ability to maintain the original bits or even to provide methods for easily evaluating whether they are the original. At the very least one has to copy the bits from one medium to another. How can we be sure that the copy was done correctly?"[105]

2.4.3 Metadata

In digital files the need for metadata is crucial in order to know what a digital file consists of and what software was used to create it, as well as any other additional information that describes the creation of the file and its content. Metadata can be grouped into three main categories which are; descriptive, structural and administrative.[106] As the name implies, descriptive metadata is describing what the digital file is representing and what the original object is, it can consist of name of creator, parts of series and searchable keywords. If a digital file has an analogue as its

[102] Giaretta, *Advanced Digital Preservation*, 205
[103] UNESCO, "Guidelines for the Preservation," UNESCO
[104] Stuart Jeffrey, "A New Digital Dark Age? Collaborative Web Tools, Social Media and Long-term Preservation," *World Archaeology*, December 5, 2012, 557, PDF.
[105] Giaretta, *Advanced Digital Preservation*, 206
[106] Humanities Advanced Technology and Information Institute, University of Glasgow and National Initiative for a Networked Cultural Heritage, "The NINCH Guide to Good." 53

original and has been digitised, it is not born with the metadata imbedded and therefore it is essential to include this.[107]

The type of information that is stored in the structural metadata can be described as data and its relationship to other data. In a digital object there are various parts that make up the file and link to other elements in it so that navigation can work smoothly, this is for example essential in 3D objects.[108]

Administrative metadata is all the information that is linked to a digital file, like date of creation, read, write and print permissions, date of creation as well as all the technical specifications of the file and software used.[109] This information is very valuable for future generations in order to access the file and to know how to handle it the best way, when for example migrating to future storage devices.

Some metadata standards that today are used are amongst others PREMIS (Preservation Metadata: Implementation Strategies) and METS (Metadata Encoding and Transmission Standard). Advantages of using PREMIS include that it can be combined and used with other types of metadata standards, and describes elements of preservation metadata that can be used on a variety of digital objects.[110] In order to obtain most compatibility on various hardware and software platforms the use of METS is an alternative, as it is compatible with the widely used XML (Extensible Mark-up Language) which is a non-proprietary open standard that allows for metadata to be expressed in a standardised way.[111] The advantage of being compatible with XML is according to Gladney that: "it is intended to be a flexible, yet tightly structured, container for all metadata necessary to describe, navigate, and maintain a digital object."[112]

Another metadata standard that has become popular is the DCMI (Dublin Core Metadata Initiative). It was first developed back in 2002 and has as some of its main

[107] *Understanding Metadata* (Bethesda, USA: NISO Press National Information Standards Organization, 2004), 1, PDF
[108] Humanities Advanced Technology and Information Institute, University of Glasgow and National Initiative for a Networked Cultural Heritage, "The NINCH Guide to Good." 53.
[109] Ibid.
[110] Harvey, *Preserving Digital Materials*, 85
[111] Ibid.
[112] Gladney, "Why We Need Long-Term," in *Preserving Digital Information*, 132

goals to make use of already existing metadata standards available, be usable on any type of platform, have a very clear outline of the basic elements that make up a digital document, and that it can be further built upon as more elements will develop in the future.[113]

2.4.4 Open-source

Open-source means that the software has been developed with the goal of keeping the source code open and available for free for any other developer to alter and preserve it without having to be limited by various licensing restrictions of big companies. In the open-source community open-source software often operates under the GPL (Gnu Public License).[114] Using open-source software can be of an advantage as the source code is open and many users and developers can work together in finding solutions to various compatibility problems of many other software and platforms.

2.4.5 Digital Preservation Policy

As we produce more and more digital material that will be needed to be preserved for a long time, memory institutions, amongst others, have a challenging task ahead of themselves. The 2009 survey by Planets asked various types of organisations from all over the world about their current situation on digital preservation.[115] Interesting to see was the participation of memory institutions. With more than over two-hundred responses, a majority of them came from Europe and the greater part of them were represented by libraries (forty-one percent) and archives (thirty percent), whereas museums stood for a mere three percent.[116] That museums are not as much represented as archives and libraries in digital preservation policies is also the result of a report by Library of Congress in 2013.

The report by Library of Congress, which covered thirty-three institutions in Europe, North America and Australia/New Zealand 2008-2013, revealed that the museum sector stood for ten percent of all published digital preservation policies in the analysis, in contrast to libraries and archives with a combined ninety percent.[117] Though the difference in numbers is quite striking Sheldon makes us aware of that one of the

[113] Borghoff et al., *Long-Term Preservation of Digital*, 136
[114] SOIMA ICCROM, "Keywords for Digitization" (paper presented at Safeguarding Sound and Image Collections, Riga and Vilnius, Latvia and Lithania, July 11, 2011), 2, PDF.
[115] Planets (Preservation and Long-term Access through Networked Services), *The Digital Divide: Assessing*, 5.
[116] Ibid.
[117] Sheldon, "Analysis of Current Digital," Library of Congress.

reasons for this big difference between archives and libraries on one hand and museums on the other, may go back decades.

In the 1960's a set of digital formats known as MARC (Machine-Readable Cataloging) was developed and introduced to libraries in order to better describe the items in their collections. As this took place in a virtual environment libraries began to develop a better understanding and experience in working with digital material. This further spread to archives and finally museums.[118] Though this may count as part of the explanation to why museums are behind, Sheldon points to another factor which is that much of museums' collections consist of analogue material as well as art which is based on technology, for example audio, video and digital, but where the focus has been more on digital conservation rather than preservation.[119] As these two factors may be part of the problem, it will be interesting to see how museums will deal with their role in the future as more and more cultural heritage material is being digitised.

2.4.6 National Archives of Australia – A Successful Example

To understand why National Archives of Australia was awarded the UNESCO/Jikji prize in 2011 for their digital preservation method, let us begin by looking at what the purpose of the prize is according to Article 1 of the statues:

> The purpose of the UNESCO/Jikji Memory of the World Prize is to commemorate the inscription of the *Buljo jikji simche yojeol*, the oldest existing book of movable metal print in the world, on the Memory of the World Register, and to reward efforts contributing to the preservation and accessibility of documentary heritage as a common heritage of humanity. The objective of the Prize is in conformity with UNESCO's policies, and is related to the programme of the Organization to foster universal access to information and knowledge.[120]

The main objectives the National Archives of Australia have when it concerns preservation of digital files are based on five criteria. They should be able to; preserve a digital file irrespectively of the data program that once created the original file; the use of computer platform that was used should not be essential; digital files should be able to be entrusted the National Archives on any kind of digital storage media; the records should be accepted from any Commonwealth agency or approved Personal Records depositor; and most importantly, be able to allow for access and discovery for today and

[118] Ibid., 10
[119] Ibid.
[120] "UNESCO/Jikji Memory of the World Prize," UNESCO, last modified 2009, accessed October 24, 2014, http://www.unesco.org/new/en/communication-and-information/flagship-project-activities/memory-of-the-world/unescojikji-prize/statutes/.

the future.[121] The National Archives has based its work on the international standard of records management (AS) which follows the ISO-standard 15489.[122]

The criteria that are listed above are not unusual amongst institutions and companies today wanting to save and have access to their digital data for the future. The National Archives extend their idea on what they want to achieve by addressing the fact that digital formats which are owned by companies, so-called propriety formats, may pose future problems. They suggest the use of software that is community-based and open which would eliminate the dependency of major technological companies on the market today and in the future.[123] This also allows for users to take advantage of collaboration and co-operation within a community that shares the same interest and goals.

The National Archives of Australia is using an open software solution known as Xena, which stands for XML Electronic Normalising of Archives.[124] This followed a decision in 2002 to create an archive that would be able to handle any type of digital format needed to be preserved.[125] The software consists of four major parts which are; *Manifest Maker* which is responsible for compiling a list of digital files that have been moved to the National Archives from various agencies, as well as the records' checksums; *Xena* where the identification of the digital file to be converted takes place, as well as the actual conversion; *Digital Preservation Recorder (DPR)* which manages the workflow of the preservation, as well as making sure that information for audit is recorded; and *Checksum Checker* that oversees any changes to digital records and thus hopefully can eliminate or minimise corruption or loss of data.[126]

The approach the National Archives is using for its digital preservation is to base it on formats where its specification is published in a fully open way, and thus take any digital file and convert it into a today existing standard open format. In order for the National Archives to minimise and avoid any damage or modification to the digital file,

[121] "Digital Preservation Policy," National Archives of Australia, accessed October 23, 2014, http://www.naa.gov.au/about-us/organisation/accountability/operations-and-preservation/digital-preservation-policy.aspx.
[122] Helen Heslop, Simon Davis, and Andrew Wilson, "An Approach to the Preservation of Digital Records," last modified 2002, pdf.
[123] "Digital Preservation Policy," National Archives of Australia.
[124] National Archives of Australia, *Digital Preservation: Illuminating the Past, Guiding the Future* (Canberra, Australia: National Archives of Australia, 2006), 3, PDF.
[125] Ibid.
[126] National Archives of Australia, *Dissecting the Digital Preservation*, 5

they are using the method of migration which will reduce the various steps that are needed to be taken to convert the file.

The conversion procedure will take place when a file is placed into the digital archive. The National Archives calls this *normalisation* and when the converting process takes place it creates a small number of files in open *preservation* formats. In order to ensure adaptability and sustainability for the future, the National Archives also make sure to keep a copy of the original file for future use if something goes wrong or new formats develop that will prove to be better.[127]

As we can see is open-standard the keyword here, as it allows for more future options and a community of users that are willing to work on preservation strategies for free. Of course the use of open-source software also requires a lot of research and testing before being implemented, as many people can provide with their own contributions.

The method the National Archives is using is described in their methodology in six steps:

- converting digital records into open-specified preservation formats
- using an open source development methodology and licensing our software under GPL. This enables us to build upon the efforts of other open source projects, so we can achieve our goals more quickly and with fewer resources
- processing files of the same file format in the same way. For example, all Microsoft Word documents are converted to Open Document Format. This approach is predictable and removes the need to make separate decisions for each new transfer we receive
- processing digital record transfers as soon as a transfer is received to give us the best chance to convert the records to a preservation format. If we encounter any issues, such as file corruption or damaged transfer media, we can address them as soon as possible
- always keeping an exact copy of the original files as they were transferred
- automating the digital preservation process as much as possible.[128]

When the National Archives decide on what kind of open software to use, it has to fulfil certain criteria. Firstly, this includes that it, as stated earlier, reveals the full specifications so that it allows for users who possess the knowledge to build and expand on the software. This also allows for a better understanding of the file format that makes up the software and thereby improves the future of long-term preservation.

[127] National Archives of Australia, *Digital Preservation: Illuminating the Past, Guiding the Future* (Canberra, Australia: National Archives of Australia, 2006), 3, PDF.
[128] National Archives of Australia, *Dissecting the Digital Preservation Software Platform*, RKS: 2009/4026 version 1.0 (2009), 7, PDF.

Secondly, the software format must not contain or be attached to any legal rights such as patents, intellectual property rights etc.[129] This is important as otherwise long term-preservation and access to data can be hindered by the fact that it is only possible to develop software that can be read or written to by owning a license from the owner of the patent.[130]

There are cases when the method of using open software does not work for certain file formats. In such cases the National Archives method of *normalisation* will be postponed and the files to be converted will be kept in their original format until a suitable method has been developed that can handle the files.[131] When dealing with long-term preservation we all would like to preserve our material as identical to the original as possible. In the case of this method it cannot be fully guaranteed.

When a *normalised* version has been created, factors like the available fonts on the system used to view this version might not be available. Nevertheless, the core of the digital record's meaning and characteristics will be preserved by its content, structure, context and visual representation in order to convey its original purpose.[132] How this is determined is made up by a combination of the chosen file format used for the preservation output file, and the way the software conversion was carried out to create the preservation file.[133] The National Archives has a list of various formats used today and have made a list of their preferred open file format, as well as an acceptable file format that these files will be converted into.

In addition to the developed output formats in open format that the National Archives has made, it has also created tools which give the possibility to export back to original formats if needed, as well as the ability in converted data to access it as it was presented.[134]

As we live in a time where both software and hardware soon are obsolete and replaced there is a major problem of long-term preservation. According to the National Archives

[129] "Digital Preservation Policy," National Archives of Australia.
[130] Ibid.
[131] "Digital Preservation Policy," National Archives of Australia.
[132] Ibid.
[133] National Archives of Australia, *Dissecting the Digital Preservation*, 8
[134] National Archives of Australia, *Digital Preservation: Illuminating the Past*, 8

this can best be summarised by the following quote: "The short lifetime of contemporary storage media means that a constant media refreshing program is the only way to ensure the survival of digital content".[135]

Even though we today face difficult problems of preservation of our digital heritage it is not impossible to preserve it. The National Archives has developed what they call the *performance model*, and claim that there is actually no absolute need to keep what they refer to as the *source* and *process* in its original condition, in order for it to one day still be regarded as genuine.[136] In order to understand this let us look into what *source* and *performance* mean:

> The *source* of a record is a fixed message that interacts with technology. This message provides the record's unique meaning, but by itself is meaningless […] since it needs to be combined with technology in order to be rendered as its *creator* intended. The *process* is the technology required to render meaning from the source. When a source is combined with a process, a *performance* is created and it is this performance that provides meaning […]. When the combination of source and process ends, so does its performance, only to be created anew the next time the source and process are combined.[137]

In other words, what is called the *source* is commonly referred to as a digital file, which contains data. This can be any kind of digital file format we are accustomed to, like a jpeg photo file, a wav sound file or a word processing file like Word. And what is referred to as the *process* is a mix of software, hardware and setup in order to interpret and understand the file format. Finally, *performance* is what is presented as the result of the reading of the file format onto, for example, a screen.[138]

By understanding this model, we can see that it is feasible to preserve the *source* (jpeg, wav, word file), but more unrealistic to preserve the *process* as the technological revisions of hardware and software take place too frequent. The main point is that as long as the most necessary components of the *performance* still can be copied over time, *source* and *process* can be considered redundant.[139] How to determine what to preserve is of course a matter of interpretation. Therefore the National Archives

[135] Heslop, Davis, and Wilson, "An Approach to the Preservation." 11
[136] Ibid.
[137] Ibid., 8f
[138] Ibid., 9
[139] Ibid., 11

developed what they call the *essence* of a record, which acts as a way to determine which attributes of a file must be preserved in order not to compromise its meaning.[140]

As not all digital records are the same and their structures differ, their *essence* also differs. This makes it very important to establish what genre of files are being analysed, whether they for example are text files, sound files or image files, as each type has its own *essence* and will according to the type it belongs to be preserved.[141] Therefore it is very important to identify what kind of file one is dealing with before any preservation measures are taken.

In order to retain the integrity of digital files there is an advantage in not subjecting them too often to preservation processes. One risk that can interfere with digital files' essence is the use of regular short-term migration. To have to double check the integrity of processed files is not only time consuming, but also costly and not for sure going to yield exact results.[142]

The National Archives is of course aware of the two common approaches of digital preservation; emulation and migration, and reminds us of the limits these two models have; "look and feel", accessibility and sustainability.[143] As described earlier in the paper regarding migration and emulation, the two methods have their advantages and disadvantages. The National Archives recognises the problem and if they would have decided to opt for any of the methods it would require a lot of work. As they state: "Ongoing migration requires intensive cyclical work to convert objects in obsolete formats to current formats." And that: Emulation requires highly skilled computer programmers to write the emulator code and sophisticated strategies to deal with any intellectual property and copyright issues […].[144]

When it concerns the question of authenticity of digital records, the National Archives view is based on the fundamental principle that: "good recordkeeping and archival

[140] Heslop, Davis, and Wilson, "An Approach to the Preservation." 13
[141] Ibid., 15
[142] Ibid., 16
[143] Ibid., 12
[144] Ibid.

systems provide access to complete, reliable and authentic records into the future."[145] How this is achieved is by making sure that no unauthorised personnel can handle the digital records as it could easily lead to alteration, or in a worst case scenario deletion of the digital material. For the National Archives the way to achieve this is by also paying attention to questions on data security, data integrity and the need for audit requirements.[146]

The advantage of using the XML standard is that the National Archives is avoiding having to go through several preservation processes, and by so limiting the effects on digital files that otherwise would occur through multiple conversations as soon as a software or hardware becomes obsolete. As the XML is open-source and not linked to any specific company the format can theoretically live on forever and thus be further developed and used.[147]

Depending on which category a future file belongs to, either an already existing plugin will be extended to include the new file type, or a completely new plugin will be developed.[148] The advantage of using plug-ins is that they can be developed at any time and implemented into the software. One example of a very common plugin today is the pdf-plugin which allows us to read pdf-files directly in our web browsers.

The question of what to do if a better system of digital preservation one day appears and the original files already have been converted and discarded is something the National Archives addresses in the following way:

> We recognise that any digital preservation conversion is not perfect and, as a result, certain characteristics of the original may be lost. As we preserve the original content of all the digital records we process, we are able to perform and reprocessing on the original digital record rather than the converted version. This helps to prevent any unnecessary loss of the original record's significant characteristics.[149]

The overall response, both nationally and internationally, to the method the National Archives has developed and is using has mainly been positive.[150] That the research, work and time have been worth it was not the least recognised by the award of the

[145] National Archives of Australia, *Digital Preservation: Illuminating the Past*, 9
[146] Ibid.
[147] Heslop, Davis, and Wilson, "An Approach to the Preservation." 18
[148] National Archives of Australia, *Dissecting the Digital Preservation*, 13
[149] National Archives of Australia, *Dissecting the Digital Preservation*, 22
[150] National Archives of Australia, *Digital Preservation: Illuminating the Past*, 8

Memory of the World Prize, Jikji, by UNESCO in 2011. Nevertheless, to find a sustainable method for digital preservation of our digital cultural heritage is still a continuous research work that currently has not led to any established, common, developed standard that works for everyone. Instead, we see various methods, sometimes used on its own, and sometimes combined with others to address the problem.

3. RESULTS AND DISCUSSION

This chapter consists of the content analysis of my sources, the conference proceedings, commencing with UNESCO followed by EU and ICOM/CIDOC in order to see if I can find answers to my initial questions on; What digital preservation solutions for digitised and born digital cultural heritage lie ahead of us?; What is the current viewpoint on open-source software as a method for digital preservation?; and How can the international community best safeguard our digital cultural heritage?

3.1 UNESCO

In analysing the sources of UNESCO I found eight out of the eleven themes I had created. The analysed themes were; social, authenticity, economy, preservation, metadata, standards, legal co-operation and co-ordination.

3.1.1 Social

Foscarini, Fiorella, Gillian Oliver, Juan Ilerbaig, and Kevin Krumrei

Preservation Cultures: Developing a Framework for a Culturally Sensitive Digital Preservation Agenda

In this paragraph on the social theme we can see that:

> […] an approach that is sensitive to the cultural variations and the 'centrifugal impulses' […] that exist between and within any human groups, should become a priority, if digital preservation is to serve the diverse needs existing in society—not just the needs of particular professional communities.[151]

The title of this paper and the above paragraph suggest to me that digital preservation must be seen in the light of differences amongst digital users. As we all belong to various social and cultural groups in our society and some consume and/or produce digital material which is not considered "mainstream" there is also a wish for this to be preserved, but current solutions are not inclusive enough. I believe this is a crucial point that needs to be addressed or else the risk is that joint work in finding suitable methods might become undermined and we will end up with a variety of solutions that might not be based on the same core, thus affecting interoperability and seamless interaction across.

[151] Fiorella Foscarini et al., "Preservation Cultures: Developing a Framework for a Culturally Sensitive Digital Preservation Agenda" (paper presented at The Memory of the World in the Digital Age: Digitization and Preservation. An international conference on permanent access to digital documentary heritage, Vancouver, British Columbia, Canada, September 26, 2012), 420, PDF.

Further we read:

> By employing a situated, empirical approach, and by leaving aside any prescriptive purposes, our research into cultural characteristics and relevant factors aims at mapping the digital landscape and identifying the different needs of any stakeholder involved. Understanding and applying the information culture concept will enable the development of a culturally sensitive framework for digital preservation.[152]

Here it is clear that collaboration is wished for between different cultural groups in society and that some groups don't see themselves as part of the digital agenda yet. If not achieved there is a risk that it slows down the work of digital preservation as a whole. This would be negative as there is an urgent need to develop sustainable methods for everyone who takes part in our digital lifestyle.

Another paragraph describes it as:

> The envisaged framework will celebrate diversity and idiosyncrasy of approaches. It will not assume that the 'right' way of doing recordkeeping should be imposed in order to correct 'deviating practices'—which we would rather call 'innovations.'[153]

Above we can read that there seems to be a fundamental problem overshadowing any initiatives to establish a framework that would work for digital preservation. It is obvious that a "one-solution-for-all" for digital preservation is not the way to go. As previously described in this paper there is more than one way of doing digital preservation, and here we can see that there are groups in society that do not think one set of rules or standards would work for everyone. Instead, a more inclusive method, or a diversity of methods is preferred as many digital records can come in a great variation of formats, each one with its own specific needs of digital preservation, and new future formats will emerge. The key point is that there is an understanding and sensibility for various cultural setups and not group all together as one.

Maria Guercio

Digital Preservation in Europe: Strategic Plans, Research Outputs and Future Implementation. The Weak Role of the Archival Institutions

Here we can read that:

> […] the European strategies for the digital heritage have marked the centrality of actions aimed at promoting the cultural contents convergence, by overcoming quite always the specificities in the research investments and favoring (and selecting) quite only projects

[152] Ibid., 430
[153] Ibid.

> able to guarantee the largest participation of cultural institutions of the widest and most variegated nature and provenance as possible: as mentioned, the focus of all the European recommendations for digitization and digital preservation was and is on convergence of domains for accessibility and for interoperability.[154]

One factor that might have influenced this is that a lot of focus has been placed on the benefits of what digitisation and creating digital cultural heritage could bring society in terms of social and cultural access. This might consequently have led to decisions being made to mainly focus on shorter-term research projects where there has been an involvement of cultural heritage institutions that have been able to achieve this.

Tony Sheppard

Is a New Legal Framework Required for Digital Preservation or Will Policy Do? Building a Legal Framework to Facilitate Long-term Preservation of Digital Heritage: A Canadian Perspective

In this paragraph we learn that:

> Canadian law currently offers a wide range of exemptions from legal obstacles and provides numerous financial incentives to encourage investing in cultural heritage, because such heritage benefits society.[155]

That digital preservation is a complicated process and has many aspects to consider is to me obvious from the text above. For society to be able to benefit from digitised and digitally preserved material in a way that is not only local but stretches over the world without boundaries, there are legal matters that need to be solved. How this is supposed to be done is not only a matter on national level but also international. I believe that there is a need for increased co-operation in order to positively succeed.

Further, we see:

> Digitalization of cultural heritage increases its availability to the public over the Internet. The resulting efficiencies, cost reductions and expanding accessibility benefit the public.[156]

[154] Maria Guercio, "Collaboration in Digital Preservation or Lack Thereof: What Works" (paper presented at The Memory of the World in the Digital Age: Digitization and Preservation. An international conference on permanent access to digital documentary heritage, Vancouver, British Columbia, Canada, September 26, 2012), 469, PDF.
[155] Tony Sheppard, "Is a New Legal Framework Required for Digital Preservation or Will Policy Do? Building a Legal Framework to Facilitate Long-term Preservation of Digital Heritage: A Canadian Perspective" (paper presented at The Memory of the World in the Digital Age: Digitization and Preservation. An international conference on permanent access to digital documentary heritage, Vancouver, British Columbia, Canada, September 26, 2012), 566, PDF.
[156] Ibid.

We know, as the text above implies, that digitisation of cultural heritage can benefit society in general by reaching out and making it available to broader audiences. Though the author states that it brings cost reductions with it, we should not forget that it comes at a cost. Though the prices for digitising equipment may go down in the future and the techniques might become simplified, there is still the problem of digital preservation that lies ahead of us as we have learned earlier in the paper. Exactly what the costs for this would be, and who would pay for it, remains to be solved.

3.1.2 Authenticity

Maria Guercio
Digital Preservation in Europe: Strategic Plans, Research Outputs and Future Implementation. The Weak Role of the Archival Institutions

The following is emphasised in this text on authenticity:

> The fact is that the European archival institutions, whose historical custodial function could have supported, with the knowledge and experience accumulated for centuries, the understanding and the translation in the technological environment of crucial concepts such as digital trust, reliability, accuracy and authenticity and identify implementation methods and tools in the field of digital preservation, have never acted as main characters or leading protagonists. They obtained merely *protection* but not recognition as crucial players for central challenges. They have not yet created an effective European network able to support research and initiatives related to digitization processes and digital preservation.[157]

This indicates to me that there is a fundamental problem in the way European archival institutions co-operate on the topic of digital preservation. Even if the archival institutions focus on different objects and artefacts to preserve and the traditional methods might differ, why is it that though years of shared similar experiences in the roles as preservers of cultural heritage they cannot manage to establish a united front? In chapter 1.4 we read about the importance of authenticity and provenance within the museum sector and here the archival institutions seem to face the same problem. Could it be that what is halting these institutions to establish a solid network is based on an underlying fear of changes that is taking place in their fields? It is obvious that the role and tasks of these professionals are about to undergo a change as society more and more is becoming digital.

[157] Guercio, "Collaboration in Digital Preservation,"473

In this sentence we find that:

> As was underlined years ago […] the digital contents in any domain "require knowledge of its context of creation, and they demand evidence of its provenance.[158]

I interpret the above as essential as it denotes that cultural heritage that is being digitised still has not found a reliable method that can guarantee this. As earlier discussed in chapter 1.4 is the need for acceptance of digital files in the field of digital cultural heritage that can prove its authenticity, one of the most pressing issues to deal with at the moment.

Here we learn:

> With specific reference to the authenticity, a rich archival literature has been developed, based on the InterPARES research and its *template for analysis*. Nevertheless, not many European projects have used this reference structure.[159]

From this source we find that there are guidelines developed concerning authenticity, but which supposedly are not often used in European research projects. Though the exact reason to why it is like this is not fully clear, it indicates to me that there are some profound problems amongst European research projects funded by the EU that need to be investigated.

3.1.3 Economy

Maria Guercio

Digital Preservation in Europe: Strategic Plans, Research Outputs and Future Implementation. The Weak Role of the Archival Institutions

Looking at the economic aspect we read:

> In the specific area of European research for digital preservation, a general and relevant critical question concerns the brief funding period always granted to the projects, no matter how promising the initiatives are: according to this policy, each research project should be able to survive and become sustainable in only 3-4 years of financial support and should be able to develop its own research center for strategic future programs.[160]

It is very peculiar that a pressing question such as digital preservation does not receive longer periods of funding as it is a long-term project. I wonder if this is related to the technological advancements that continuously take place and which make decision makers doubt the real need to invest in long-term solutions. As these advancements

[158] Ibid., 478
[159] Ibid.
[160] Guercio, "Collaboration in Digital Preservation," 473

occur on a regular basis, there might be an attitude that short-term solutions are better and more economic. If so, then the understanding of the digital preservation dilemma might not have been properly understood.

Tony Sheppard

Is a New Legal Framework Required for Digital Preservation or Will Policy Do? Building a Legal Framework to Facilitate Long-term Preservation of Digital Heritage: A Canadian Perspective

In this paragraph the following is said:

> Projects for the digitalization and preservation of cultural heritage require funding […]. Government grants can be made available, but current economic realities constrain public funding, necessitating greater recourse to private sources of capital for funding. In a market economy, cultural heritage may not compete favorably for funding against other less risky and more lucrative endeavors.[161]

Preservation of digital cultural heritage is a financial matter. Digitisation and digital preservation projects cost money and some memory institutions which are small might not have enough funding to embark on long-term digital preservation projects. The question on who shall be responsible for it is a question that needs to be addressed. If digital preservation methods become too difficult and complicated the risk is that proper measures are not taken, in order to save on expenses. This could have catastrophic consequences, especially for born digital heritage.

Richard Marcoux, Laurent Richard and Mamadou Kani Konaté

Digital Preservation of Demographic Heritage: Population Censuses and Experiences in Mali and the Democratic Republic of the Congo

In the following quote we learn that:

> […] Mali was in the middle of preparations to conduct its 4th national population census. The archives director was quite worried about the idea of having to handle a stock of more than five million, A3-sized documents that represented all the questionnaires for the 2009 census. One of the options under consideration was to destroy the documents from the 1976 and 1987 censuses so as to free up the space needed to accommodate the questionnaires for the 2009 census.[162]

[161] Sheppard, "Is a New Legal," 566

[162] Richard Marcoux, Laurent Richard, and Mamadou Kani Konaté, "Digital Preservation of Demographic Heritage Population Censuses and Experiences in Mali and the Democratic Republic of the Congo" (paper presented at The Memory of the World in the Digital Age: Digitization and Preservation.

In analysing this paragraph I see how it illustrates two issues at once. Though digitisation can seem to be an attractive method in reducing physical storage space for records and allowing for easier and faster access on one hand, I can on the other hand see the problem of continued work with digital material and its preservation. This is as we have learned earlier, not just a matter on buying more storage space, but, amongst others, about finding and developing sustainable and economic methods, policies and routines for continuous work.

Further, we see that:

> The possibility that data from numerous African censuses could disappear completely is a danger that needs to be addressed, given the financial investments they required.[163]

This sentence indicates that there is a growing fear of how to handle digital data that is being created. As I previously have mentioned in this paper, digitisation is not the same as digital preservation, and for many involved stakeholders working with digital material it is an absolute need to be attentive to the need for digital preservation policies in order to properly care for digitised material. In addition, as digitisation and digital preservation projects can be costly, it is not only essential to secure the financial needs, but also to be able to train relevant personnel in working and caring for digital records in the future.

3.1.4 Preservation

Richard Marcoux, Laurent Richard and Mamadou Kani Konaté

Digital Preservation of Demographic Heritage: Population Censuses and Experiences in Mali and the Democratic Republic of the Congo

Regarding preservation the following paragraph informs us that:

> Computerized data storage technologies have evolved at such a rapid pace that, quite often, with no measures having been adopted to transfer the data to new storage media, the data from earlier censuses have now been completely lost — either because the media once used to store such information is now obsolete, or because they have simply disappeared, […][164]

From the data analysed above we can see that without proper digitisation and digital preservation policies, the consequences can become very unfortunate. In the example of

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An international conference on permanent access to digital documentary heritage, Vancouver, British Columbia, Canada, September 26, 2012), 678, PDF.

[163] Ibid., 676

[164] Ibid., 677

the population censuses that were lost we see a discouraging scenario of what can happen to valuable digital heritage information that is not properly cared for. I see a need for increased co-operation on all levels; research, policy, economic, technological and legal in order to address these issues. The lost material is not isolated to a developing country like in this case but can happen to anyone, anywhere, at any time.

3.1.5 Metadata

Joseph T. Tennis

Data, Documents, and Memory: A Taxonomy of Sources in Relation to Digital Preservation and Authenticity Metadata

Regarding metadata we see that:

> This means that in constructing a coherent picture of a fonds or describing the provenance of a body of records, theory guides the archivist to document his or her decisions made. This documentation must also follow the record through various stages of preservation—persisting along with the records.[165]

This paragraph suggests to me that when it concerns the question on authenticity of digital records there is a big problem of trust regarding them. This is because even if metadata as a way of ensuring provenance is created and added to a digital file, there is always the fear that it does not follow whenever records are being moved. This is something that we have learned earlier can happen, especially with the migration method where digital preservation has to be updated to new hardware storage devices on a regular basis and there is a risk that the copying of the file and its structure goes wrong.

Here we can read:

> In the process of drafting a metadata application profile that is consistent with diplomatic assumptions about records, […] we found that metadata alone could not maintain presumption of authenticity in digital records systems through time.[166]

I interpret the above paragraph as that though metadata is essential to a record's authenticity it is not enough. Though it serves as a very important part of a digital record it needs further development in order to become sustainable for the future. As I

[165] Joseph T. Tennis, "A Taxonomy of Sources in Relation to Digital Preservation and Authenticity Metadata" (paper presented at The Memory of the World in the Digital Age: Digitization and Preservation. An international conference on permanent access to digital documentary heritage, Vancouver, British Columbia, Canada, September 26, 2012), 934, PDF.
[166] Tennis, "A Taxonomy of Sources," 935

presented in chapter 1.4 we could see the importance and problems of authenticity that exist with museum objects and records. One of the reasons to museums' ambivalent standpoint on digitisation and digital cultural heritage might lie in the fact that the question on authenticity and provenance has not yet been satisfactorily solved, which otherwise could guarantee trustworthiness of their digital collections.

Further, that:

> The lifecycle of a body of records has been represented in ideal form in the Chain of Preservation model […] Through this model we have begun to enumerate the metadata required for the presumption of authenticity […] We call our metadata the IPAM, which stands for InterPARES Authenticity Metadata.[167]

The above text suggests that although metadata already exist in various forms it is still not to full satisfaction and that there is an obvious need to further develop already existing versions. There is need for collaboration and development of standards that can be agreed upon in order to achieve digital preservation systems that will be robust, trustworthy and lasting.

And that:

> The final documentation is Preservation Documentation. We hypothesize that this category of documentation is relevant from a contingent definition of preserver. […]. Preservation documentation consists of authentication reports, preservation feasibility reports, disposition reports, state-of-records reports […].[168]

This points to that although metadata in a digital file in itself is of great importance with regards to authenticity and provenance it also needs to be complemented with documentation. I find this very good as digital records easily can be copied, duplicated and stored in many different places throughout its lifetime. This can very easily lead to confusion of where files originate from and what changes they might have gone through. These aspects are important as files and its content also can become corrupt due to previous storage carriers that might have been infected by viruses or malware.

3.1.6 Standards

Maria Guercio

Digital Preservation in Europe: Strategic Plans, Research Outputs and Future Implementation. The Weak Role of the Archival Institutions

[167] Ibid., 936
[168] Ibid., 939

Analysing this paragraph on standards shows us that:

> […] it has been impossible to develop at the European level a strategy toward a systematic and standardized approach for electronic recordkeeping and preservation systems. […] this delay has prevented the archival and record management community from providing effectively […] its contribution to the research in the specific field of digital preservation and to the definition of digitization standards and parameters.[169]

That the archival community seems to have missed their chance on influencing European research works on achieving standards regarding digital preservation is unfortunate. To me this attitude indicates that the problem is on a level of co-operation. Either there exist enough different methods for record keeping which each memory institution already has implemented and the costs of developing, alternatively, updating to new standards is considered too high. Or, it is a matter of prestige where each memory institution is holding on to their respective system and is not willing to compromise. Whatever the specific reason is, it is regrettable.

Further we learn:

> […], someone could object that digital preservation systems already follow a standardized reference model, […] the OAIS model. […] This model is today and will remain for a long-time the benchmark for digital preservation projects, but (also because of its nature necessarily open, flexible and abstract), it is unable to meet more specific requirements.[170]

To me this suggests that digital preservation is very complex. Even though the OAIS reference model exists and has its advantages it also has disadvantages, which could be read in chapter 2.4.2. One problem related to this is the speed and development of new digital technology that take place. As we see more opportunities to use digital technology in our society it will consequently lead to new digital file formats and devices developed. With these new socio-cultural contexts developing, depending on one standard like the OAIS reference model might prove limiting. It is important that further research is undertaken into alternative standards so we do not risk locking ourselves into one standard that might prove inadequate in the long run.

[169] Guercio, "Collaboration in Digital Preservation," 469
[170] Ibid., 477

3.1.7 Legal

Tony Sheppard

Is a New Legal Framework Required for Digital Preservation or Will Policy Do? Building a Legal Framework to Facilitate Long-term Preservation of Digital Heritage: A Canadian Perspective

Looking at legal we find that:

> The foundation of a country's laws and society is its constitution. Therefore, in building a legal framework for the preservation of digital cultural heritage within a State, the starting-point should be consideration of whether or not to reform its constitution.[171]

I consider this important as it indicates that preservation of digital cultural heritage is much more multi-faceted than file formats and hardware, which we mainly have been reading about in this paper. Digital material is also protected by copyright and various domestic laws and this will inevitably lead to problems in a digital world where Internet transcends borders. The questions on using, sharing and preservation of digital cultural heritage need to be addressed on an international level in order for countries to allow for seamless interaction amongst its users.

In addition that:

> Harmonization of the domestic laws of different jurisdictions is also desirable, […] in dealing with a common problem such as the preservation of digital heritage. A possible route would be for each jurisdiction, separately and independently, to develop its own domestic legislation dealing with the preservation of its digital heritage.[172]

To me this paragraph indicates that if legal questions on local level are not first satisfactorily solved it will naturally pose further obstacles on a global scale. As I in the beginning of this paper showed can digital cultural heritage have a positive benefit on our society, but as we learn here it can also be hindered by legal issues. It is therefore important that, from a European perspective, the EU also focus on the harmonisation of law when addressing questions on digital preservation.

Further, we find:

> When copyright protects a work from use without consent of the current owner, and the owner of the copyright cannot be identified or located to give consent, the work is said to be an "orphan." In the absence of legislation, usage of the orphan work is frozen.[173]

[171] Sheppard, "Is a New Legal," 563
[172] Ibid., 564
[173] Ibid., 567

That copyright law plays an important role in any kind of work is important, but as we can learn here it can also have its limitations. This can lead to that many cultural work and treasures are being exempted from the digitising projects that are undertaken, which would lead to limitations of cultural accessibility. That there is need to consider and maybe revise domestic and international laws is essential when it concerns digitisation and digital preservation of cultural heritage.

3.1.8 Co-operation

Maria Guercio

Digital Preservation in Europe: Strategic Plans, Research Outputs and Future Implementation. The Weak Role of the Archival Institutions

Regarding co-operation the following is to read:

> The role and the relevance of the European effort in this research area are undeniable, but they have not been able to re-create […] the InterPARES atmosphere of international cooperation and a similar original and authoritative contribution to the research in one scientific domain (in case of InterPARES, the preservation of authentic digital records) and to the enlargement of the interdisciplinary cooperation boundaries.[174]

From this source we can see critique against Europe and international co-operation on research programs. I consider this relevant because EU has been one of the major actors in financially supporting various EU-programs on research in digital heritage, digitisation and preservation, but it seems that current work is characterised by disunity. As digital preservation is not limited to digital data but, amongst others, also include legal, economic, and cultural questions it is very important that EU takes on a united leading role and show that work is characterised by a multidisciplinary approach, otherwise the risk is a development of different fragmented solutions taking its own direction.

This paragraph reveals that:

> Dublin Core Initiative, the OAIS model, Encoded Archival Description standard, digital curation paradigm, audit framework for trusted digital repositories are just some of the best known products, developed in one sector or thanks to the strict coordination of archival and librarian scholars and professionals and transformed into general and basic elements and tools for building enhanced infrastructures. None of them has been implemented thanks to European funds.[175]

[174] Guercio, "Collaboration in Digital Preservation," 468
[175] Ibid.

If international collaboration does not work satisfactorily it is of great concern. In the efforts of trying to solve the problems of digital preservation, authenticity and provenance of digital records, co-operation is essential as these questions are not isolated to any specific country or region. EU has previously invested in research of digital preservation solutions and could play a vital role in the development and co-operation between various European countries and institutions on the topic. If it fails there is always the risk that memory institutions will seek alternative solutions.

With regards to memory institutions we learn that:

> It has to be said that the institutions of memory (mainly the archival organizations) have shown here their limited capacity for developing strategic alliances (relevant not only for funding and for exploiting finance channels but mainly to create strong and permanent institutional interconnections.[176]

In the source, critique aimed at memory institutions for not having been able to establish alliances amongst themselves is interesting. Whether this could be part of the reason to why museums are behind in developing digital preservation strategies can be worth thinking of. If joining forces with other memory institutions, museums could have a joint platform to work from and strengthen their voice, influence and the direction taken in the development on digital preservation research by EU.

Here we find that:

> Good methods, good concepts, consistent vocabulary cannot be provided when the knowledge is not well developed and openly discussed and if the boundaries are still unclear or even completely unknown.[177]

The above points to me that it is necessary within EU research programs to unite and start talking the "same language" in order to achieve common goals. The disconnected approach that currently seems to be in place is not beneficial for any of the stakeholders involved. When working on solutions for long-term digital preservation there is a need for transparency and openness amongst everyone involved.

[176] Ibid., 470
[177] Ibid., 481

Tony Sheppard

Is a New Legal Framework Required for Digital Preservation or Will Policy Do? Building a Legal Framework to Facilitate Long-term Preservation of Digital Heritage: A Canadian Perspective

In the following paragraph we can read:

> From an international perspective, if each State develops its legislation on its own, the result would be a patchwork of domestic laws at best. Collective effort under the auspices of an international body such as UNESCO might be more effective to harmonize domestic laws.[178]

In a country where many different domestic laws exist there is a need for co-operation and unity in finding new frameworks that would work for digital preservation and digital cultural heritage online. Internet as a place for access to digital cultural heritage puts strain on existing laws which make it hard to abide and adhere to already established legal frameworks. That UNESCO possibly would play a role in the harmonisation of domestic laws suggests to me that the current situation is too big to be dealt with on a local level. There is a need by a unified body to approach digital cultural heritage and digital preservation.

Richard Marcoux, Laurent Richard and Mamadou Kani Konaté

Digital Preservation of Demographic Heritage: Population Censuses and Experiences in Mali and the Democratic Republic of the Congo

Here we read:

> A second, noteworthy, American initiative is the African Census Analysis Project (ACAP) of the University of Pennsylvania which helped safeguard the databases of more than 50 censuses from 26 African countries.[179]

The paragraph above indicates an answer to one of my initial questions on what can be done to safeguard our digital cultural heritage. We learn that co-operation is vital, not only on local level, but also internationally. This is especially true for countries that may have embarked on digitisation projects, but do not have the full financial infrastructure to take it to the next level and properly preserve their digital cultural heritage in a sustainable way.

[178] Sheppard, "Is a New Legal," 565
[179] Marcoux, Richard, and Konaté, "Digital Preservation of Demographic," 677

3.2 EU

In the analysed paper of the European Commission seven themes were found; authenticity, economy, standards, legal, co-operation, co-ordination and technology.

European Commission

Report of the Proceedings of the Workshop – The Future of the Past – Shaping new visions for EU-research in digital preservation

3.2.1 Authenticity

Looking at the following paragraph on authenticity we find:

> There are problems over metadata, persistent identifiers and certifiable access. There are also broader issues over standardisation, workflows, provenance and authority. There is a requirement for a standards body in this area: should the EU create it?[180]

As the main focus, with financial support of the EU, in recent years has been on digitising cultural heritage, digitisation projects have been initiated by many institutions. For memory institutions, this question is of importance in general, but maybe even more so for museums as I presented in chapter 1.4. I believe that the culprit to the certain hesitancy on digital cultural heritage partly is based on the questions on authenticity, trustworthiness and provenance. From the above source I understand it as there is uncertainty and dissatisfaction on how and who should take the lead in the work on the development of digital cultural heritage preservation solutions.

3.2.2 Economy

This source on the economy theme reveals that:

> Missing, however, were Industrial Partners who would be the consumers of digital preservation solutions as producers of digital material to be preserved. For this group, he feared that the long- term nature of digital preservation was incompatible with current economic modelling in which investment required short-term returns.[181]

That the financial significance regarding industrial partners in long-term digital preservation projects might not be compatible with current economic models is important. I believe that it might be one circumstance to why the EU's funding of research programs usually are relatively short, as criticised in one of the sources presented at the UNESCO conference. Investing in long-term digital preservation

[180] European Commission, "Report on the Proceedings of the Workshop The Future of the Past – Shaping new visions for EU-research in digital preservation." (paper presented at Cultural Heritage and Technology Enhanced Learning. European Commission Information Society and Media Directorate-General, Luxembourg, Luxembourg, May 4, 2011), 28, PDF.
[181] Ibid., 8

solutions might be seen as very uncertain investments due to its digital nature, which constantly is changing.

In this paragraph we learn that:

> There is a challenge, however, that while some data formats are attractive to commercial providers to provide preservation solutions, there is also a 'long tail' of formats where the quantities are too small to justify investment in a preservation solution.[182]

That profit is an important aspect of any business undertaken is no surprise and no exception to digital preservation. In an environment where an excess of digital formats exist, some commercial and others based on open-source and free, I believe that the reluctance amongst stakeholders to invest in long-term digital preservation solutions can pose an obstacle to further development of digital preservation systems. This is especially true where open-source communities parallel work for free to provide answers to complex questions.

The importance of policy and economy is illustrated through:

> Increasingly, organisations are developing digital preservation policies, but it is important that policy is linked to both financial and technological planning if a sustainable approach is to be achieved.[183]

It is positive to learn from this source that digital preservation strategies are increasingly being developed, but as we previously have seen is the economic aspect of profit an important factor in the development of digital preservation solutions. I think this points to that there is a need to better co-ordinate and co-operate on the development of long-term digital preservation, as it otherwise will remain fragmented as it now seems to be.

3.2.3 Standards

On standards this paragraph shows us that:

> There will be universal digital preservation policies and standards to assist organisations in deciding what to preserve and what to discard.[184]

To me the above sounds like a simplified solution to a very complex problem. We have earlier in this paper analysed one source which was concerned about the lack of cultural sensitivity when it comes to digitisation and digital preservation, and to think that universal policies or standards will be the answer is something I am sceptical to.

[182] Ibid. 11
[183] Ibid.
[184] Ibid., 13

Though it in the end will be necessary for a consensus of standards, I believe that we will see a variety of standards and polices side by side, developed to suit each area that works on digital preservation.

Her we can read that:

> This work needs to be addressed at European level owing to the EC's leadership role, which would promote partnership working with international bodies. Without such leadership, there will a proliferation of commercially-driven proprietary standards – such a multiplicity will cause confusion.[185]

From this source my impression is that digital preservation in the EU seems to be lacking a clear direction. Though a lot of money has been spent on digital cultural heritage and digital preservation projects there seems to be a lack of co-operation and strong leadership.

Further, that:

> There are a number of options: to produce new standards or to facilitate the use of existing ones by organisations. It will be necessary to identify gaps in standards and also to recognise that different domains apply different standards.[186]

That the work on developing digital preservation standards is difficult is clear from the above paragraph. The impression I get is that the discussions on standards is met with desire, hesitation and caution. The point that is addressed are relevant and I think it is necessary for the EU to take on a leading role and evaluate the current situation in Europe first, and then continue work internationally as this is a problem that needs to be addressed on all levels.

3.2.4 Legal

The theme legal reveals:

> Development of policies that encourage the opening of access to and sharing of data, with easy rights clearance.[187]

Here we can see that, as we did in chapter 1.4 and the discussion on access and sharing of data within museums, there is concern about the legal aspects of digital material and the sharing of it. This is a very important matter as digital material very easily can be shared amongst its users. The question is whether current legislation is up-to-date on

[185] Ibid., 28
[186] Ibid.
[187] Ibid., 18

this and if producers of digital content know how to deal with it in order for users to be able to easily benefit from it.

3.2.5 Co-operation

In this paragraph on co-operation we learn that:

> Digital preservation professionals and computer scientists inhabit different worlds. Experience suggests that memory institutions only consider solutions which they have developed themselves. Communications needs to be improved between these communities so that existing solutions can be adopted and not duplicated.[188]

Once again we come across the importance of co-operation in the case of digital preservation. The source suggests that memory institutions are having a problematic attitude in finding suitable solutions to common work. This is very unfortunate, and holding on to solutions and technology that once were developed and proved useful at the time created, might today need to undergo an update. An unwillingness to compromise, adapt and co-operate on current situations and seeing cultural heritage in a much wider digital, both European and international, perspective risks slowing down and hindering future development.

3.2.6 Co-ordination

Looking at the theme of co-ordination reveals that:

> Co-ordination activities between projects – possibly a Network of Excellence.[189]

To me, this sentence indicates that work on digital preservation on EU-level is not satisfactorily met, fragmented and not integrated in a harmonious way as it could be. This is problematic because if anyone would be able to take on a leading role in co-ordinating the complex work of digital preservation on a European level, it would be the EU.

3.2.7 Technology

We can in the following on technology learn that:

> Emulation must provide a simple user experience, which is difficult to achieve.[190]

As we earlier have learned are two of the most current alternatives of digital preservation migration and emulation. Emulation has been considered relatively complicated and this is confirmed in this source. I believe that if digital preservation is

[188] Ibid., 19
[189] Ibid., 18
[190] Ibid., 20

to reach the common user in an easy and affordable way the alternative will be based on the migration method. Though, professional users might see advantages in using emulation which will require more advanced hardware and skills. The problems we learn about digital preservation might be related to the fact that certain areas in society have needs that differ from the average user, and therefore global solutions are not suitable to every user, and specific ones also need to be developed.

In the following paragraph we can see that:

> He proposed a number of topics worthy of further research work. Digital Preservation Infrastructure – develop the concepts of Digital Preservation as a service and preservation-ready file systems Digital Content[191]

With an approach where we would buy or rent digital preservation it might prove beneficial for some, but smaller institutions or businesses might not have the financial means for it and still decide to preserve their digital material themselves, which without adequate knowledge on how to do so can prove disastrous.

Further, we can in the following paragraph read how:

> There has been a change in focus from how institutions could preserve data to how best to store the digital objects themselves, with responsibility shifting from the instution to the creator of the digital material.[192]

The above is interesting as it obviously is a difference in the preservation of data and the storage of it. It suggests to me that to only focus on memory institutions as being responsible for preservation is not enough, the whole question on digital material must extend to include storage solutions as well. I believe that it has to do with the increased amount of digital material we are producing, and as we most likely cannot preserve everything it will be necessary to find alternative ways that also allow us to store digital material in a suitable way.

In addition, that:

> Projects have mainly focused on the preservation of 'traditional' digital objects – e.g. word processing documents and images. There is now a need to consider newer format of digital objects – for example the outputs from social networks, in which it is as important to preserve the process as the objects themselves.[193]

[191] Ibid. 9
[192] Ibid., 10
[193] Ibid.

Increased development in technological digital services, like social media, will inevitably lead to needs for further research on digital preservation techniques. Therefore, increased collaboration between all partners involved is essential.

Here we can read:

> There is now a problem that the volume of digital information cannot be managed by human intervention alone. In order for digital preservation to be an economic activity, automation must be applied.[194]

Questions on whether this type of technology is to become available for all of us as digital consumers, or only for professionals in the field of digital preservation remains to be seen. A further aspect is the development of this kind of systems, here again we see the need for co-operation between the research communities and software industry. By using automation where producers of digital content for example do not have to manually enter information related to digital files which are to be digitally preserved, or forgetting to fill in information of importance relating to the authenticity of a digital record, might eliminate the risk of doing something wrong.

And that:

> Self-preserving objects are seen by many as the 'Holy Grail' of preservation, but no individual research team has the capacity to address this problem. In order to influence the software industry to engage in this approach, a large and powerful consortium must be formed and must also engage with a large communities involved in digital preservation.[195]

Important aspects on an approach like this are costs, availability and who will have access to this type of systems. As mentioned earlier in the case of the population census records in Africa, digitisation and digital preservation can be very expensive and with the speed and new amounts of digital material that is produced, economic factors play a vital role in who can afford this type of solutions.

[194] Ibid., 25
[195] Ibid. 30

3.3 ICOM/CIDOC

Analysing ICOM/CIDOC presented me with six themes; social, authenticity, standards, co-operation, policy and technology.

3.3.1 Social

Benny Sand

Ecological Knowledge Management for the Arts and Culture Industry in the Digital Era

The theme social reveals the following:

> The adoption of social media became important agenda throughout the museum sector. When executed correctly, the results are extremely beneficial to a museum or any other cultural institution.[196]

I consider the above relevant as the author implies that museums have begun seeing the importance of social media in their work. As we could read in chapter 1.4 can the benefits of adapting to new ways of conducting work benefit society as a whole. This way of democratisation, as it sometimes is referred to, allows us to much easier than before take part in various sectors of life, one example being cultural institutions. Already now it is necessary to be able to preserve new digital material which is being generated through the use of social media and cultural and memory institutions.

In the following paragraph the author claims that:

> the must condition for a successful Eco KM solution in a museum is the acceptance and recognition that the Social media is here and for good. Understanding and internalizing that avoiding this phenomenon will generate severe and chronic damages, while adapting it will improve all the parameters and will contribute to it survival and success in a significant manner.[197]

This is important as social media has become an integral part of our lives and is used in many different ways. We have entered a new time and if social media can be used within the museum sector to read, interpret, create, re-create and share culture amongst its users in new ways it can be beneficial for society as a whole. Culture is not static but dynamic and evolves with time and changes in society and this is what we now are experiencing. It is not necessary to completely give up old traditions, but lack of

[196] Benny Sand, "Ecological Knowledge Management for the Arts and Culture Industry in the Digital Era" (paper presented at Access and Understanding – Networking in the Digital Era. Digital Long Term Preservation, Dresden, Germany, September 6, 2014), 4, PDF.
[197] Ibid., 5

adaptation, merging with new technologies and being accessible online will most likely, like the author implies, be of a disadvantage to museums.

Further, we find that:

> The social impact of the Web2.0 which strengthen the social network and reinforces the spectator, weather he is facing the cultural object in a frontal manner or on a virtual one bundled with the operational constrains of Museums leave them no choice rather then adapt themselves to this reality and relate to this knowledge accordingly and respectfully.[198]

The text above by the author on how museums are dealing with the challenge of social media in its current form is disturbing. We learn that some see the current approach towards the technological advancements as limiting for the museum visitor. I interpret this as that there is an underlying fear of change within parts of the museum community. Whether it is fear of too rapid changes for museums, with regards to social media and technology in general, or fears of changes in the professional roles of museum staff, or a combination of both is worth considering.

3.3.2 Authenticity

Caspar Almander

Using Common Specifications in the Public Sector (PowerPoint presentation with accompanied paper for each slide)

On authenticity we read the following:

> It is important to know that all information is left as it is. All information remains in its original state.[199]

In the text the importance of authenticity is emphasised and this is something we have come across earlier regarding digital records. We can see that authenticity is not solely a question for memory institutions, but also for other public and private sectors as well. As more areas of our society become digital and produce information questions on of how it can be used or abused, and how to preserve it is becoming more pressing and it is currently difficult to find good solutions. This brings with it that there are many actors on the market trying to find suitable answers to these questions.

[198] Ibid.

[199] Caspar Almander, "Using Common Specifications in the Public Sector" (paper presented at Access and Understanding – Networking in the Digital Era. Digital Long Term Preservation, Dresden, Germany, September 6, 2014), 2, PDF.

3.3.3 Standards

Caspar Almander

Using Common Specifications in the Public Sector (PowerPoint presentation with accompanied paper for each slide)

Regarding standards we find in the following paragraph:

> It's a "one standard fits all solution", leading to easy and standardized information exchange.[200]

It is interesting to see that the archive, which handles many different types of data, claims this to be a "one standard fits all solution". I am sceptical to this claim about standardisation and though it might work with several current standards, there exist several other solutions to many other smaller digital formats which also are used in various places. In addition, with the aspect of digital preservation it would be interesting to know the compatibility regarding authenticity of digital records.

Further, we understand that:

> Already from the beginning the City Archives of Eskilstuna saw the need for the common specifications and it's beneficial consequences for the the total organization.[201]

As answer to one of my questions we again see that co-operation is emphasised and that it in this case concerns standards. Though this presentation was not directly talking about digital preservation, we can see that there is an awareness of the problems associated with digital records and authenticity in that it refers to the "total organisation", which I understand as everything from the handling of digital records, compatibility between different formats, metadata, and digital preservation.

In addition, that:

> The common specifications guarantee that information is captured, transferred, kept and easy available for re-use in the future.[202]

We can learn that in a jungle of different standards there is a desire to create a common solution in order to deal with digital material in an uncomplicated way. Though, as seen earlier in one of the sources, not everyone believes in solutions that suit everyone, but

[200] Ibid. 4
[201] Ibid.
[202] Ibid.

rather advocate for specific solutions depending on specific needs. Nevertheless, I believe that in the end certain standards will be developed that more or less allow for seamless interaction.

Gustavo Aquino dos Reis

Guidelines for the organization and preservation of the digital archive of the Football Museum

In the following paragraph we can see a list of points that the museum find important:

> Structural organization of the directories corresponding to the different areas of the museum;
> Standardization of nomenclature of the digital documents;
> Evaluation of digital garbage;
> Guidelines for the assurance of the reliability and authenticity of electronic documents;
> Preservation of electronic files in an extension who ensures the impossibility of change, both in content and in form;
> Application of audit trails for monitoring the management of electronic documents;
> Definition of access controls.[203]

Once again we see that one of the pressing questions to be addressed is a need for standardisation, a common language to speak when dealing with digital material. In addition, as discussed in chapter 1.4, we can also see that concern for authenticity and manipulation of files stored in a repository is of great importance, as well as a need for audit in order to make sure management of digital records are properly done. One interesting aspect that is brought up on this list is the "evaluation of digital garbage". I find this important because we have previously learned from discussions on digital preservation that we might have to begin making decisions on what we want to, and can, preserve due to the enormous amounts that we create.

3.3.4 Co-operation

Caspar Almander

Using Common Specifications in the Public Sector (PowerPoint presentation with accompanied paper for each slide)

In this text on co-operation we can read:

> Of course, implementing these common specifications cost. It's a matter of implementing. It's a matter of mapping. It's a matter of working together.[204]

[203] Gustavo Aquino dos Reis, "Guidelines for the organization and preservation of the digital archive of the Football Museum" (paper presented at Access and Understanding – Networking in the Digital Era. Digital Long Term Preservation, Dresden, Germany, September 6, 2014), 2, PDF.

In order to use digital common specifications in the public sector we can here see, as also previously found on EU and UNESCO level relating to research or legal questions, that co-operation is important. I think this is one crucial point and we have earlier seen the supposed difficulties of some memory institutions to create strong partnerships and influence European digital preservation research. The financial aspect and investments done in digital work is for any stakeholder a crucial factor in any kind of co-operation work.

3.3.5 Policy

Gustavo Aquino dos Reis

Guidelines for the organization and preservation of the digital archive of the Football Museum

In policy we learn that:

> These documents are created in a great profusion, in an organic way, and most of times, after used they pass to be totally unseen and, without any concern to develop a well-structured policy of archival management who would allow its digital preservation and the recovering of the information, they are moved to the digital repositories confirming the typical and reckless motto: "preserve and forget".[205]

As we produce ever increasing amounts of digital material it is easy that digital preservation can become an overwhelming task to deal with, especially without proper structure, guidelines or policies implemented. To me it is obvious that the digital life style we have created is putting strain on established policies and preservation methods that are in place. Digital preservation poses new challenges and there is a need to find methods on how to deal with this overflow of information that is being created. One example where a new or updated type of policy might be necessary is in the accessibility to digital material, what can and should be made available with a click from any digital device?

3.3.6 Technology

Gustavo Aquino dos Reis

Guidelines for the organization and preservation of the digital archive of the Football Museum

In this text we read about technology:

[204] Almander, "Using Common Specifications in the Public," 4.
[205] Aquino dos Reis, "Guidelines for the organization," 2.

> […], the main point is that the industry sells the idea that the digital preservation is done by making investments in storage and backups, forgetting to mention many other parallel activities that are crucial for the safeguard of the electronic records.[206]

That there seems to be incorrect information and understanding on the complexity of digital preservation and what the surrounding needs are is clear. It appears that some believe that digital preservation is only about technology and investing in physical storage media will solve everything. As I presented earlier in this paper are museums behind in the development of digital preservation strategies. To me this is alarming as it is one of the major factors that need to be addressed from the beginning on in order to be prepared for the challenges that digital preservation presents. As earlier pointed out, digital preservation is not a short-term project and its goals and methods need to clearly be defined before commencing.

Benny Sand

Ecological Knowledge Management for the Arts and Culture Industry in the Digital Era

This paragraph is explained as:

> Once it comes to the technological infrastructure planning and implementing an Eco KM solution is challenging yet doable. The concept should be up to date it should be able to respond to the frequent changes by adapting new technologies and concepts such as open source, Saas & cloud and Agile project management approach.[207]

We can see that in the described new approach of Eco KM it is suggested that museums need to be able to respond and be up to date to meet changes that frequently take place. To me this indicates that within the digital preservation community there are groups that are interested in taking advantage of the open-source community and the technological developments that take place there. This might seem as a better alternative and provide for faster, up-to-date solutions than having to wait for commercial stakeholders to react and deliver.

[206] Ibid., 3
[207] Sand, "Ecological Knowledge Management for the Arts," 4.

4. CONCLUSION

Analysing the eleven different themes I created for my sources in order to answer my initial questions revealed that there is indeed a strong need for not only co-ordination, but also co-operation in the field of digital preservation of digital cultural heritage. The sources have made it clear that there are certain areas that are in specific need to be addressed.

Looking at my question on *How can the international community best safeguard our digital cultural heritage?*, I can through the analysed sources conclude that the most pressing areas include work on developing standards, addressing questions on authenticity and provenance of digital records, and a need for increased and better co-operation between various EU-research programs in the work on developing digital preservation solutions. The critique on EU also concerned the length on digital preservation projects which was seen as too short. The role UNESCO could play in harmonisation of various legal and domestic laws relating to digital cultural heritage was also addressed. That co-operation is vital was not the least illustrated through the case of the African population censuses that were lost.

In the digital environment we today live in we do not only consume digital culture, but also create, re-create and share it. We do not only do this on a national level, but internationally as well, and all of this digital material needs to be digitally preserved. Though the sources investigated did not provide for a solution on how to best achieve this, they pointed to the importance of co-operation in this field in order to settle several key questions that are closely interlinked.

Regarding my question on *What is the current viewpoint on open-source software as a method for digital preservation?*, I could not find any direct answer from my sources which I found a bit surprising. Though it is in use as we learned from the example of the National Archives of Australia and was awarded the UNESCO Memory of the World Prize, only one of the conference proceedings referred to the use of it, though not exclusively as a digital preservation solution. Whether this has to do with a lack of proper understanding of the concept of open-source is not clear. In a digital preservation community where thoughts on security and authenticity have proved to be some of the

most addressed and vital questions, the word *open-source* might imply the opposite, and therefore not seen as a reliable alternative.

On the question on *What digital preservation solutions for digitised and born digital cultural heritage lie ahead of us?*, my sources revealed that we might see digital preservation that takes place as automated processes and self-preserving digital records. In addition, it was mentioned that digital preservation one day might develop into some sort of a service being offered, possibly by subscription or purchasing means.

Though museums were *not* the main focus of this paper we could also learn that by looking at museums and their role to digital cultural heritage, we could see that adaptation to new technologies is desired for, and that there is a need for standards to be developed.

The challenge of digital preservation of cultural heritage in digital form lies in that we all have to participate in finding solutions to the problems we have seen in this paper. It has proven to be a challenge that requires co-operation and co-ordination on all levels related to it.

As we are living in a digital connected world where we experience, create, re-create and share digital cultural information on an everyday basis, this is a challenge that concerns all of us if we want to be able to save this digital cultural heritage for future generations to come.

The way we decide to achieve this might differ from case to case as we learned that a "one-solution-for-all" is not always desired for, but rather, an understanding of cultural differences and specific needs. Whether the solution used will be developed on a commercial basis or in an open-source environment, as in the example of National Archives of Australia, might not prove to be the most important matter. As long as the needs for security, authenticity, trustworthiness, interoperability and seamless integration between institutions and their audiences are met, we might be on the right track.

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