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1. EXECUTIVE SUMMARY

This document builds upon the Report: State of the Art on Virtual Museums in Europe and Outside Europe (Deliverable 2.3) developed by the Virtual Museum Transnational Project (V-MUST.NET) and delivered 30 September 2011, which was based on the Work Package 2 “House of Questions,” which endeavoured to establish requirements and criteria analysis for the Virtual Museum domain. D.2.3 incorporated research on the state of the art on Virtual Museums set out in Deliverables 2.1 and Deliverable 2.2 while developing the research concerning Virtual Museums in Europe and beyond.

While this report: State of the art of Virtual Museums in Europe and Beyond: and Recommendations for the Field Based upon Current Practice draws on previous work as stated above, we now propose to present an overview of the Virtual Museum; based on best practice as identified in previous deliverables. In addition the report outlines a series of recommendations, as practical considerations towards conceptualizing, designing, and implementing a Virtual Museum (Virtual Museum).

The term Virtual Museum has become so ubiquitous as to rend it almost redundant. It is therefore critical to state here our definition of the Virtual Museum in order to be able to debate what is, and what is not relevant to this discussion. Once our terms of reference have been clarified we move to discuss the Virtual Museum in more detail; and in section 3 we discuss the basic components of the Virtual Museum as reflected in our previous research, and will introduce how the term Virtual Museum has in fact been used to describe a wide range of activities that are all somehow loosely concerned with this overarching concept. Both the Virtual Museum that acts as the digital footprint of a physical museum, as well as those Virtual Museums that have no reference to the physical world draw on the strengths of the term museum; as familiar to all as a bricks and mortar building that houses and maintains material collections on behalf of the public. Questions of authority and authenticity inevitably emerge from these kinds of discussions, yet it isn’t always clear who does have the authority; and possibly the capability to author such projects. Questions such as these will be raised in the following section. The core of a Virtual Museum can be loosely described as a location of rich content – often including unique and precious objects or works of art – but once collections, or exhibitions have been assembled they can be integrated as different kinds of experiences, with an equally impressive wide range of different activities and varying depths of interactivity. A Virtual Museum can tell a story; it can inspire you to tell your own story; it can take you to places that no longer exist or help you gather objects that are meaningful to you. The following section is concerned in outlining these possibilities, and serves to classify their differences as well as their commonalities. The term Virtual Museum can therefore reflect many different ways in which objects have been assembled, presented, and disseminated over electronic platforms; representing artistic expression, re-enacting a forgotten archaeological period, or creating a historical setting.
In section 4 we turn to the educational and pedagogical aspects of the Virtual Museum in order to establish how Virtual Museums can support, and actively contribute to formal, and informal learning scenarios. When users seek information about the world around them and ask all kinds of questions about lived life, or artistic, and historical processes, they will probably be searching for them first and foremost online and/or on their smart phone. As soon as the term ‘museum’ is invoked, users get a sense of trust with an impression they are encountering content that has been professionally collected, curated and presented in the tradition of the museum. Quality cultural content that either describes itself, or is described by others as a Virtual Museum when discovered online, over mobile platforms or at specific venues has obvious resonance with both formal and informal education. This section discusses the potential for advantageous collaborations between cultural institutions that seamlessly deliver their content into the classroom, the home or community venue.

Section 5 breaks down the different kinds of museums typographically, setting out the kinds of content, experiences, and interactions that are already available as Virtual Museum’s worldwide. Clearly the electronic art museum or art gallery provides a very different ontological experience than does a virtual walk through a simulated historical site; as does the questions posed by a science museum or the kinds of experiences that one might expect to encounter in an ethnographic museum. The following section discusses the different kind of content Virtual Museum’s already deliver, and describes the different ways in which each kind of museum can extend its institutional goals and messages over a Virtual Museum.

In much the same way that Virtual Museum’s may reflect a broad range of experiences – whether representing a bricks and mortar museum, physical site or an imagined collection – the following section deals more with delivery rather than with content; in spite of the fact that neither content nor delivery can be truly separated in a Virtual Museum. Knowing where the end user can most benefit from the cultural content, designers and curators of Virtual Museums will need to decide where, and how to deliver the experience. The various scenarios introduced in this section clarify the scope and scale at the point of delivery; all factors that affect the quality of experience that is delivered to end-users. The following section introduces a comprehensive discussion of the narrative both in the Virtual Museum as well in film and introduces the classification and the different schematic models of the narrative.

The last section is concerned with a series of recommendations for the production of a Virtual Museum and refers to specifically, the currently standards, and the technological solutions that are now becoming common practice. This section continues with a discussion of the role of the Virtual Museum in a Web 2.0 world where the ‘prosumer’ is king, and users expect to produce and disseminate their own micro-content while at the same time consuming the content of others; both authoritative as well as peer driven. This section concludes with concrete recommendations for producing Virtual Museums, and a checklist to enable institutions and individuals to think about practical solutions and the various steps this entails when authoring their own Virtual Museum.
2. INTRODUCTION AND ANALYSIS OF WP2 RESULTS

This report draws upon the survey in the previous deliverable Deliverable 2.3, which identified and described 90 Virtual Museums in Europe and beyond (p.11). The Deliverable 2.3 concluded how most of the Virtual Museums surveyed are predominately dedicated to historical and archaeological content and posits that there is a need to virtually recreate the fragments of history that have disappeared over time to communicate and to reconstruct our past. Building on this premise this report seeks to extend the conversation to a broader range of types of Virtual Museums (section 5), which is critical to our discussion about the potential for the Virtual Museum, and the way in which they can ‘carry’ different kinds of content that was not previously possible in the real world of the physical museum and the embodied collection.

One of the ways in which the bricks and mortar museum is held accountable to society is through the sharing of cultural and scientific heritage with its public (as described also in Deliverable 2.3 in the discussion on museum definitions). As reflected in all these definitions it is clear that custodial responsibility to the collection demands the professional management of the material artefacts to ensure their safekeeping for future generations. This, it may be argued, represents the central function of the museum, as without its collection, the museum would cease to exist. In addition, museums are obligated to develop and maintain discrete areas that present the collection for display opening up these areas and granting public access to them. These sometimes-conflicting obligations – the conservation of the material collection, and the responsibility to share the collections with the public – are reflected in the professional definition of the museum.²

The International Council of Museums (ICOM) defines the museum, as follows:

A museum is a non-profit making, permanent institution in the service of society and of its development, and open to the public, which acquires, conserves, researches, communicates and exhibits, for purposes of study, education and enjoyment, material evidence of people and their environment.

ICOM Statutes, adopted by the Eleventh General Assembly of ICOM, Copenhagen, 14 June 1974³

In this way, the museum affirms its institutional mission not only to collect and conserve collections, but also to display them, and in doing so expresses its obligations to facilitating study, education and enjoyment of the material collection. ICOM definition fundamentally acknowledges the material collection as the core of the mission, and recognises how the museum, in contrast to the world of television, theatre and advertising, prioritises the tangible artefact. However, in addition to the material artefact, the museum is also defined as a space that communicates its messages to its audience, and, in this bid to impart the museum message, it overlaps with other media and traditional communication apparatuses in many ways.
Over the last decade, the museum has evolved to broaden its professional mandate, and is beginning to welcome a wider-ranging spectrum of museum practices into the institutional mission. The departure from ‘tangibility’ as the exclusive rationale of the object-driven museum is reflected in debates over the last decade in the museum community, where the introduction of ‘intangibility’ is indicative of the expanding museum mission. A UNESCO meeting held in March 2001 adopted the provisional definition of intangible cultural heritage and endorsed the concept of ‘learned processes’ as a vital component of the [intangible] museum. Giovanni Pinna, Chairman of ICOM-Italy, and Member of the ICOM Executive Council defined the intangible museum as:

Peoples’ learned processes along with the knowledge, skills and creativity that inform and are developed by them, the products they create, and the resources, spaces and other aspects of social and natural context necessary to their sustainability; these processes provide living communities with a sense of continuity with previous generations and are important to cultural identity, as well as to the safeguarding of cultural diversity and the creativity of humanity (Pinna 2003: 3).

The auxiliary or supporting texts, which had been incidental to the primary object, were now being promoted by ICOM as primary texts, and museum professionals were encouraged to integrate them accordingly into museum practice. Intangible expressions, however, demanded the introduction of new disciplines for collecting and display, and three categories of intangible cultural heritage were set out to describe their parameters. The first category, according to Pinna, included the physical expression of the culture of communities: religious rites, traditional economies, ways of life, folklore, etc. The individual or collective expressions that did not have a physical form were placed in the second category: language, memory, oral traditions, songs and non-written traditional music, etc. In this case a critical role for museums was envisioned in the conservation and preservation of intangible artefacts through recordings and transcriptions for intangible heritage. This, Pinna suggested, would transform intangible cultural heritage into tangible heritage and preserve it as historical and cultural testimony. The third category included the symbolic and metaphorical meanings of the objects, which, it was argued, constituted tangible heritage in a category that encapsulates an object’s links from past to present (ibid). In spite of these clarifications and the description of the separate categories, the implications of these processes were still somewhat ambiguous and demanded further explanation and supplementary professional support.

The new concepts of intangibility were instituted into the museum community in several ways. ICOM celebrates International Museum Day on May 18 every year. The theme selected by the Advisory Committee for 2004, as well as the theme for the 2004 triennial conference, was intangible heritage, acknowledging that although the concept of heritage has been dominated by its tangible embodiments, intangible heritage is no less a vital ingredient of every civilisation (Pinna 2003: 3). The term ‘intangible’ in the museum context required more than a little explanation, even before the idea of digital creativity was to be grafted onto the (already complex) idea of intangibility. Amar Galla, Chair of the Asia-Pacific Organisation of the International Council of Museums (ICOM-ASPAC), was asked to clarify the ICOM position on intangibility, and went on to produce new guidelines for the incorporation of intangible heritage into museum practice. His ‘Frequently Asked Questions about Intangible Heritage’ included issues such as whether intangible heritage can be a vehicle for education and cultural action, and, if curators are involved with intangible
These principles presented new challenges for museums and museum practitioners, and, in addition to the guidelines set out in the special ICOM News: *Museums and Intangible Heritage*, 2003, the ICOM General Conference in Seoul, which took place in the autumn of 2004, specifically focused on intangibility. Conference participants were invited (perhaps with the aim of demonstrating ‘learned processes’) to performances of traditional Korean performing arts, Shaman dance, Pansori (Korean epic chants), and Ancestral Ritual Music and Dance. At the National Museum of Korea and, at other conference venues, participants met ‘living treasures’, and watched demonstrations of traditional knotting techniques, paperflower making and woodcarving. According to the UNESCO portal on ‘Living Human Treasures’, the Government of the Republic of Korea introduced its own system in 1964 to ensure the preservation and transmission of their intangible cultural properties to future generations, while in 1950, the Government of Japan recognised ‘bearers of the skills and techniques essential for the continuation of certain important intangible cultural properties’. These individuals were designated as ‘Living National Treasures,’ and a full list describes similar practices in the Philippines, Thailand, Romania, and France and many other countries.

None of these categories were intrinsically novel for ethnographic or anthropological museums, but the prioritisation of intangible elements was a significant action. The innovation encouraged the display of intangible elements. However, *how* they were to be displayed was another question. It fell to the museums themselves to preserve the ‘traces’ of the performances and they took over responsibility for documenting all kinds of performed intangible heritage such as oral history, folk life, religious ceremonies, and storytelling. The link between living heritage and documentation, therefore, was forged by the following amendment to the definition of the museum, where digital processes soon became the preferred modality for documentation.

In the July of 2001, the 20th General Assembly of ICOM association amended the statutes (as quoted above) in Barcelona, Spain, to include in the museum definition:

*Cultural centres and other entities that facilitate the preservation, continuation and management of tangible or intangible heritage resources (living heritage and digital creative activity)* (ICOM Statutes amended by the 20th General Assembly of ICOM, Barcelona, Spain, 6 July 2001, clause viii).

Combining the idea of digital creativity with the core notion of ‘the museum’ provides us with a useful foundation from which to continue this discussion, but first it is important to clarify the differences (and similarities) of those Virtual Museums that act as the footprint of physical museum, and those other kinds of Virtual Museums that are born digital.
3. DEFINING THE VIRTUAL MUSEUM (VIRTUAL MUSEUM)

3.1. THE PHYSICAL MUSEUM AND THE BORN DIGITAL

It seems that every community needs a museum. Capital cities all over the world invest vast sums in building them, towns devote considerable resources into running them, and rural communities across the world often draw great pride from them. The institution of the museum in contemporary society is a social phenomenon that is as ubiquitous as the local or national park. But unlike a relaxing stroll in the park, both local and distant visitors come through the door in order to visit the material collections, and the visual evidence that represents, and somehow even defines, whole communities. At the same time, the kinds of Virtual Museums are essentially digital systems in situ located in the physical museum, as well as the institutional websites that reaffirm the physical museum, all act as miniature representations of the bricks-and-mortar museum. Our discussion of the Virtual Museum, however, extends also to other kinds of Virtual Museums – including those virtual representations of cultural heritage or historical processes that have no link to a physical museum – those Virtual Museums that have been created independent of a physical museum and have been born digital with their own agenda.

To return to the idea of a museum, we must recognise how unlike the world of the theatre or cinema, a museum is first and foremost conceptualised as a physical location – a space that is dedicated to the material collections and traditionally, where museum activities revolve around the central fulcrum of the material artefact. Objects enter the museum in many different ways, but once accessioned into the museum, they are prepared, and staged in preparation for public display. The symbiotic relationship between the museum and its public recognises that access to the collections is an intrinsic component of the museum mission. We wouldn’t demand to visit a private collection, for example, housed perhaps in a private, or even stately home, but we do expect to be able to enter a museum, at our convenience, in order to enjoy the collections when we – the public – desire to do so. Designated under national and international legislation such as ICOM, UNESCO and national authorities, collections are in fact held in custody by the museum on behalf of the public, and the obligation to make the collections accessible to the public is regulated by institutional policies. Once located in the museum, the institution takes on its custodial responsibility for the collection, as inscribed in legislation, and with this responsibility comes accountability – not only to the museum’s stakeholders (board of directors, management, and local constituencies) – but also to the public.

In the same way that all fields of life have undergone tectonic shifts in production and consumption since the advent of the information revolution, so new media has transformed museum practice in several ways, but, unlike other mediated activities, the museum is the only institution with the material object located at its epicentre. These now mediated experiences therefore may be perceived to stand in diametric opposition to what has traditionally been conceived of as the core function of the museum, the physical object and the embedded collections.
It is this materiality that imbues museum objects with their conviction, and when the original is not available, a material replica (rather than a textual description) may be substituted instead to fill in the missing gaps. An example of this kind of substitution was evident in the placing of a Rosetta Stone replica in the exhibition *Hieroglyphics around Nefertiti* at the Kulturforum, Potsdamer Platz, in Berlin in the spring of 2005. The inscription of the royal decree, praising King Ptolemy V is written three times in the original Stone, once in hieroglyphic, once in demotic (Egyptian alphabetic language), and once in Greek, and represents the "key" to deciphering ancient Egyptian hieroglyphics. The Berlin exhibition demonstrated how a replica might substitute a key object in order to present an unbroken narrative, located, in this case, far away from the original, located in the British Museum. This suggests that the material facsimile had far more presence through its physicality than any text description could have, and, in the case of this exhibition at the Kulturforum, the fake Rosetta Stone was labeled (in German) exactly as such. Choosing the appropriate physical or digital solutions to these kinds of broken or incomplete narratives can be resolved in many ways; V-MUST.net focuses on the digital solution; and the ways in which digital platforms can iterate, augment, and even replace physical expressions of cultural heritage, artistic practice, and scientific processes.

V-MUST also concludes that by using the term *museum* both for the representation of the physical Virtual Museum and the imagined Virtual Museum imbues these platforms with the very same qualities of the physical museum – authenticity, integrity and the representation of the original. In addition we argue that the Virtual Museum acts as distinct from other kinds of activities through their role in society as a museum dictates that these mediated experiences are separate and distinguished from other mediated experiences such as cinema, television, and the Internet.

### 3.2 LOCATING THE VIRTUAL MUSEUM

One of the roles of a museum is to collect, conserve and display objects that reflect cultural heritage and scientific processes. To describe cultural heritage we argue that communities needs to convey a testimony of their lived life, to be able to convey their creative expressions while securing the traces of their history for future generations. Cultural heritage therefore can be described as a bridge of this two-way process, paving the pathways that connect the past, to the present and to the future. As a receptacle of memory, it embodies the symbolic value of cultural identities and constitutes a fundamental reference for structuring society.

But who is capable of producing Virtual Museum’s that imbue these characteristics and convey them to the public with the prescribed authenticity and integrity that is expected from an actor that calls itself a museum and who holds the authority to promote cultural heritage in the public domain?

Referring to *The New Renaissance, Report of the Comité des Sages*:

> For centuries, libraries, archives, and museums from across Europe have been the custodians of our rich and diverse cultural heritage. They have preserved and provided access to the testimonies of knowledge, beauty,
and imagination, such as sculptures, paintings, music, and literature. The new information technologies have created unbelievable opportunities to make this common heritage more accessible for all. Culture is following the digital path and "memory institutions" are adapting the way in which they communicate with their public (New Renaissance Report, P.4).

This realistic approach calls to publically funded institutions in a bid to draw on their institutional knowledge and seek new kinds of partnerships with players from the private sector to develop Europe’s cultural heritage over digital platforms. This has many benefits for society; both for the individual user who will be able to interact with their own cultural heritage in novel ways, as well as the use and re-use of rich content as important building blocks of the digital economy. The potential for new private and public partnerships and the advantages this could generate for society was described in the same report:

In an environment where the market for mobile applications is growing rapidly - some estimations expect the global market for apps to grow to $32 billion in 2015 widely available cultural material will be a key asset for new services (The New Renaissance, Report of the Comité des Sages, 8.1.3.3).

Please refer to the Deliverable Report 2.3 where there are many examples of such private and public partnerships in the examples of the Virtual Museums surveyed.

3.3 EXHIBITING CULTURE: ATOMISED COLLECTION, CURATED EXHIBITION, 3D, AR.

This section looks to the experience of the end-user and the different kinds of Virtual Museum drawing on the examples of Virtual Museum that were surveyed in Deliverable 2.3.

The atomised collection

As discussed above, we argue that the core of the museum experience lies in the collection. Virtual Museums now allow the end-user to reach straight into the internal workings of the museum directly from the PC or smart phone to access what was once the proprietary of the museum; the curator’s card. Delving into the belly of the museum in this way grants direct access not only to the individual digital images that represent the physical collection, but also to the knowledge system embedded within. The seamlessness of this action is almost presumed – we no longer go to the bank to access our money as we rely on similar electronic systems to replace traditional services – but whether we wish to access our cultural heritage so instantly is another question. Even though the museum maintains the policy of open access to visitors in the physical world, when we access the entire breadth and depth of a museum collection from our own home, school or office we experience a definite sense of agency at the immediacy of accessing the digital holdings. If previously we had the choice of hauling heavy catalogues home after an exhibition visit we can now freely access images, videos and text descriptions to our hearts content with almost unlimited frenzy. The impact of all this direct access to all this content however, now available so effortlessly opens up questions of the dumbing down of cultural content, especially when it is ripped out of the context of its
Having said that, if we do choose to consume our museum content over an electronic platform these systems do have has obvious advantages and hold great attraction for the end-user. What would have been previously unmanageable in a print medium in sheer volume, and intolerable in terms of cost, is now available to everyone at the click of a mouse. In addition, the digital environment facilitates autonomous access; allowing end-users to choose their own route through the pathways, while offering the possibility of new kinds of connections to the collections, data bases, simulations, and entire exhibitions.

What is problematic, however, is the inherent telematic nature of the Virtual Museum; an experience, which distances the visitor from the physical gallery, from its material collections and embedded context. While web authors invest considerable time and energy in making images speedily accessible – through limiting images usually to a low-resolution solution and intentionally creating optimised systems for speed – it is precisely this immediacy of access that makes the process so alarmingly effortless. The speed factor, the ‘click to go’ phenomenon, may actually act as a disservice to the collections and may cause the disembedding of cultural systems.

The curated exhibition

Once of the ways in which authors of a Virtual Museum can re-embed the atomised cultural object is by re-contextualising it in a curated environment as an exhibition. The physical museum organises the narratives into thematic order through a scholarly interpretation of the physical objects, and, as these narratives develop so the taxonomic ordering of knowledge emerges. The Virtual Museum often follows the same logic; rather instead of the material object in the gallery, the digital image takes the place of the physical object while re-enacting the same conceptual scenario. This does help explain how the same terms are invoked when describing the Virtual Museum – the gallery, the exhibition, and the online visitor, as all terms resonant with the physical museum signing that is familiar to us with from our own reality.

Objects mobilised in the gallery – either the material or virtual – clearly have been selected and mobilised for their specific qualities, but, depending on where they have been resourced, they function in totally different ways both in the physical museum and in the Virtual Museum. In the case of the art object they may serve to bedazzle the visitor, or alternatively in the case of a historical object they may be mobilised to de-mystify, and clarify the narrative. Like a film, with its own internal temporal logic, the exhibition story is driven by a succession of moments – each one punctuated with an object or artefact – coming together to communicate the story that consequently becomes strangely familiar – or alternatively, strangely exotic.

3D Simulations

Taking the emulation of a real space one step further, the 3D simulation creates an even more persuasive rendering of the physical space; inviting the end-user to travel the Virtual Museum across either predetermined pathways, or to traverse the simulation freely at their own pace. A 3D simulation may reproduce a space that the end-user might have visited, or plans to visit in the future, or it could recreate a space inspired from historical documentation; or drawings or photographs from locations that no longer
exist. There is a certain magic in this kind of reconstruction where visitors, from their vantage point within the miniature world gain a sense of the entire picture; a gestalt insight into whole.

The potential to recreate locations based on a physical reality can be aided by 3D laser scanners and specially designed imaging equipment. Scanning can take place in extremely high resolution, sampling even the smallest details from the archaeological site or historical evidence. Electronic data is fully interoperable, and can potentially be used for a range of applications, both small-scale virtual reality projects that can be disseminated over PC’s and mobile networks, as well large-scale productions that can resemble the location in minute detail and on a one to one scale. These kinds of Virtual Museum’s act as mimesis for the real world, and are irrevocably associated with the material reality of the space they represent, and the world they describe. While the simulation might be situated outside of the current chronological reality and the physical locality of the end-user, the 3D Virtual Museum can re-enact the past in the present, setting up an engaging interaction; making a forgotten or lost old culture immediately accessible and potentially relevant to today’s visitors.

Janet Murray, Senior Research Scientist at the Center for Educational Computing Initiatives, MIT describes how

... every age seeks out the appropriate medium in which to confront the unanswerable questions of human existence. We cannot limit ourselves to Elizabethan or Victorian forms any more than Shakespeare could have written within the conventions of the Aristolian tragedy or the medieval Passion play (1997: 280).

Murray takes Hamlet to the Holodeck, and investigates the possibilities for new narratives across cyberspace, and describes how the computer is reshaping the stories we tell and the conventions for storytelling. She suggests three aesthetics that drive these narratives – immersion, agency and transformation – that work together to describe a new medium of storytelling. Although none of the three aesthetics that Murray cites are fundamentally new in terms of the narrative, or for that matter to museum practice, they do appear to describe the essential qualities of the hyperlinked and non-linear modalities of the electronically-driven narratives that resist the confinements of printed books and the strictly linear stories they are telling.

Augmented reality

This section describes the overlapping of reality and fantasy; the combining of the real and the virtual into one. Augmented reality Virtual Museums are both based in reality but over-cast reality with digitally created layers. Layers can be superimposed over real-time photograph imagery of a geographic location – similar to the way we travel across Google Earth, or alternatively augmented as 3D projections layered over the physical object or location.

In addition to the integration of new visual content, audio content can offer a kind of ‘voice over’ and signals can be picked up from other users or triggers in the immediate environment exploiting the appliance’s built-in compass, gyroscope, Bluetooth receptor, or GPS locator. This kind of mingling of realities allows new information to be delivered at the point of interaction, and can be refreshed at convenient intervals according the user’s needs and desires. There are many obvious uses for this kind of Virtual Museum but, at
the same time, a persuasive augmented reality experience can be still quite difficult to deliver. An excess of information is often disturbing, and unless great care has been taken in developing the interaction, they can at times be quite disorientating. When they do work, however, and there are many examples of excellent Virtual Museums that are driven by AR, they can wondrous places that integrate all sorts of rich content into the narrative.

Now that many of these features are built-in on smart phones and tablets, we are beginning to see a proliferation of these kinds of experiences built into apps that are readily downloadable and intuitive to use. It follows that Virtual Museums in turn will move into these arenas and, as reported in the Horizon Report, 2011 Museum Edition, there is an expectation of uptake of AR for the museum community with a horizon of two or three years to adoption\(12\).

3.4 CONSUMING THE VIRTUAL MUSEUM AND THE END-USER (ACTIVE, INTERACTIVE, IMMERSIVE, NETWORKED)

It is almost redundant to apply the following terms when discussing the Virtual Museum, activity, interactivity, immersion and networking, but, for the sake of clarity we would like to bracket each of these concepts so that when we do use the terms in our discussion, we invoke a specific meaning for our reader.

Active

The very base of interactions in an electronic environment is predicated on the active user. We use this term to describe the deterministic action of the user who, unlike with the linear, and passive unveiling of a movie or TV program, determines the route, the pace, and direction taken. At the same time the active user doesn’t demand too much from the system; there is no expectation of response by the system other than responding to user’s directional clicks, and there is no expectation of surprises or distractions from the task at hand.

Interactive

The interactive user, however, does expect to stimulate the system and to receive a response from the system that is determined by his or her actions. Searching across a database could be described as interaction, when the outcome is predicated on the environment just as much as it is on the user-determined actions.

Immersive

The immersive environment demands something more from the system and the user. A deliberate suspense of disbelief is the defining quality of this kind of experience. The user is expected to believe in the magic of the environment, through a ‘stickiness’ of interaction, which is compelling and engaging. An immersive system needs to deliver these kinds of experiences seamlessly; while responding to the user appropriately, and in real time. These kinds of interactions propels the user to other places and other times, causing a cognitive shift from that allows the user to telematically separate from his physical body while fully engaged in an alternate reality. The suspense of disbelief factor is not evident only in immersive Virtual
Museum’s but has also been described either other kinds of experiences were this is disjunction from reality; such as reading a novel or a cinema experience. The difference here is the symbiotic nature of the system: unlike reading a book or watching a movie, the user acts in the Virtual Museum, and his actions cause direct, immediate, and persuasive results.

**Networked**

A Virtual Museum that is determined by a networked environment is dependent on the action of other systems or individuals that respond in real-time to the task at hand. Once the network is broken, (e.g. wireless or Internet service is no longer available), the system fails, and can no longer deliver its functions or content.

**4. EDUCATIONAL AND PEDAGOGICAL ASPECTS OF THE VIRTUAL MUSEUM**

Virtual Museums are usually designed for the general public rather than exclusively for a special audience such as tourists, community centres or schools, but clearly all these kinds of agencies will find them relevant for their on-going activities. This section focuses on the ways that Virtual Museums can be useful as educational resources, and describes how their built-in pedagogical qualities make them attractive to many different kinds of educational arenas; adult learners, college faculty and students, K-12 teachers and students, as well as for arts curricula taught in schools and in community projects. The rich content embedded in Virtual Museums can be transported directly into the classroom, can be enjoyed by families in the home, and can act as useful resources for museum educators both in the physical museum and beyond. Not every child or adult might have an opportunity to visit a physical museum in his or her lifetime but there probably will be many more opportunities to encounter museum quality content once accessed electronically. In addition, the self-directed learning scenarios encountered in a Virtual Museum create a sense of agency when accessed in the home, at the office or in school, making museum resources attractive as spaces for learning where the users can navigate at their own pace. Knowing this – schools, and places of higher learning can turn to a Virtual Museum where they will be confident they will find content that is accurate, reliable and will be able to appropriate content from the Virtual Museum directly into their own workflow.

Placing resources in the public realm is also advantageous to the museum mission, offering them the confidence that their knowledge-bases and curatorial content may be harnessed by a greater circle of users than those audiences who may actually visit their museum; enabling them, for example, to reach out to under-served populations or remote communities. This section discusses the advantages of placing the Virtual Museum’s resources directly into the public realm for both formal and informal teaching and learning.

**4.1 FORMAL EDUCATION - K-12**

There are many opportunities for schools to integrate Virtual Museum resources in the classroom; especially
so when the k-12 content dovetails directly into the school curriculum. While quality content is available online from many kinds of agencies; TV channels, libraries, archives and the schools themselves, there is a particular cachet for content that has been conceptualised as a Virtual Museum. Often we see new kinds of partnerships evolving between these difference kinds of agencies, including partnerships with Wikipedia, such as the GLAM WikiProject (Galleries, Libraries, Archives & Museums), which view these partnerships as advantageous to both sides.

Specific resources can be found on Virtual Museums include games, printable worksheets, videos and imagery that relate to museum content but have been orchestrated with a specific age group in mind. The resources now available are so numerous that a separate report would be needed to cover this extensive list, but they would include resources posted for K-12 activities in the classroom, before or after a museum visit or as a stand-alone to support inquiry to the subject taught in class.

The Horizon Report (2011) was written with this premise in mind where they state:

Collection-related rich media are becoming increasingly valuable assets in digital interpretation. Museums are beginning to see the value in developing formal strategies for capturing high quality media documentation at every opportunity. Curators and content specialists are working more closely than ever with educators and technologists to embrace the opportunities provided by using digital resources to enhance multimodal learning both online and in the galleries. (HORIZON REPORT, 2011, P.4)

The New Renaissance Report (2011) also clearly states the relevance for the Virtual Museum for supporting key skills development in schools and how the digitisation of rich content; typically found in Virtual Museum’s can benefit the wider access to and democratisation of culture and knowledge, as well as the benefits for the educational system - both schools and universities (P.5). A clear a directive for the re-use of Europe’s digitised material is expressed in the same Report in section 4.4.1 where it states that Public domain material digitised with public money should be freely available for non-commercial re-use by citizens, schools, universities, non-governmental and other organisations. In addition, the Report also recommends allocating substantive funds in order to reach this important goal.

The objectives of New Strategic Plan 2009-2013, of the Canadian Museums Association focuses on its main values of: accessibility, accountability, co-operation, diversity, innovation, integrity, lifelong learning, pride and respect (P.5) – clearly expressing its dedication to the educational aspects of its mission are clear priorities of its proposed activities. Similar mission statements of government agencies and individual museums often list the production and dissemination of educational resources amongst their priorities.

To sum up the advantages Virtual Museums for K-12 educations include: - providing a critical mass of tertiary resources for teaching and learning, opening up opportunities to hone key skills and beyond, a source for both curricula and non-curricula activities, and the potential to stimulate and inspire creativity.

4.2 FORMAL EDUCATION – ACADEMIC

The relationship between museums and places of higher learning has a long history. Not only are the artefacts, artworks, archaeological objects and specimens located in museums critical for academic research, the knowledge woven round the collections are directly related to academic and scientific inquiry...
and are often, in fact authored by universities in partnership with museums. Between the 17\textsuperscript{th} and 19\textsuperscript{th} century, young noblemen aspiring to complete their education were sent on the Grand Tour; an exploratory voyage of leading museums and music centres across Europe, safe in the knowledge that once this obligation had been carried out they were fit to join the ranks of their peers who, each in their turn undertook their own rite of passage. The spoils of such a voyage would include artworks and artefacts they would bring back with them that were to serve as their own cabinet of curiosity; or micro-museum that was set up in private homes, literally as a cabinet; or with the more sumptuous collections taking up even an entire room.

Knowledge in this way was established, and the understanding of the world as a rational matrix could be set out in the material artefacts, drawing on the juxtapositions and their relationships to each other. This very same rational is still evident today with massive databases of content that sets up paths of knowledge, no longer residing in the privacy of the home but in the public domain for all to share. The critical mass of these kinds of online collections attends to the wealth of public knowledge that is now being collected, displayed, and shared in the public domain. Here again, in the same way that a K-12 education is managed by partnerships, the academic and Virtual Museum partnerships attest to the new ways in which knowledge is generated, curated and openly accessible to the public. Where once academic processes were carried out in campuses and beyond the confines of the museum wall, these very same processes are now available to all. Here the role of the Virtual Museum is both pivotal and critical.

In addition the critical mass of content now accessible through Virtual Museums has become incrementally richer, as the technological platforms have evolved to support more efficient delivery and speed of access. With the original browser available in the middle 1990’s as Virtual Museums first appeared, users could access the holdings of museum over simple html pages where the low-resolution image could be positioned on a template either on the right, left or at centre of the page, with the text displayed either above or below the images. Both network solutions, and the evolution of complex platforms now support a much more engaging experience for the user, with the potential to deliver entire simulations in real-time with compellingly immersive interactions. Objects can now be magnified and minute details are now available for academic inquiry. With photography now available across the spectrum, scholars can now go ‘behind the canvas’, or deep into the atomic layer of the archaeological artefact with infrared, x-ray, and ultra-violet imagery. At the same time platforms can bring together disparate or missing content that might be residing in two or more locations in order to bring together the separated pieces into a renewed whole. New iterations of the Semantic web enable the seamless aggregation of these objects that might reside in collections located at a great geographic distance from one another. The advance of Virtual Museums over the last decade has opened up vast areas for academic inquiry, while closing up the considerable distances our young nobleman had to travel in order to complete his education.

4.3 INFORMAL EDUCATION

New kinds of interactive experiences that Virtual Museums can now provide give the public opportunities to interrogate a database representing the entire holding of a museum; they grant access to numerous resources that were traditionally only available in formal education; and they offer all kinds of opportunities to interact with the Virtual Museum and other players in compelling ways.
A discussed in the previous section, the kinds of electronic scenarios available both inside and beyond the museum walls, now shift the point of entrance to the home, the office or the school making those individuals welcome, who may otherwise have not even thought about going into a physical museum. This, in turn gives rise to all sorts of informal scenarios for learning once that content, and knowledge has been released into the public domain and made accessible to everyone.

The traditional mandate of the museum is to preserve, display, and interpret extraordinary objects. Bringing together notions of museum and community is very much on keeping with the Web 2.0 notion of a participatory culture – with inevitable repercussions that will be discussed in detail in a later section – and the opportunities to create communities of shared interest are potentially attractive. Virtual Museums now offer exactly these new kinds of spaces that don’t necessarily orchestrate community interactions but in fact act as facilitators of them; and inspire within them opportunities for individual and distributed creativity. The notion of a museum as described by James Clifford’s as ‘contact zones’ (1997) conceptualises the museum as a space of crossing and negotiation. The idea of a ‘contact zone’ is a useful way to describe the kinds of encounters that take place online. Clifford borrows the term ‘contact zones’ from Mary Louise Pratt, who in her book *Imperial Eyes: Travel and Transculturation*, defines the ‘contact zone’ as the space of colonial encounters, the space in which peoples geographically and historically separated come into contact with each other and establish on-going relations, usually involving conditions of coercion, radical inequality, and intractable conflict (Pratt 1992: 6-7, quoted in Clifford 1997: 192).

For Clifford, however, the idea of a contact zone:

“… can be extended to include cultural relations within the same state, region, or city – in the centers rather than the frontiers of nations and empires. The distances at issue here are more social than geographic. For most inhabitants of a poor neighborhood, located perhaps just blocks or a short bus ride from a fine-arts museum, the museum might as well be on another continent.”

(Clifford 1997: 204)

The Virtual Museum, therefore, can act as a potential space to reverse the role of curated and curatee, granting everyone the same opportunity to contribute his or her own story or content to the shared pool of knowledge. Once the barriers to access have been taken down, the rich content residing in Virtual Museums offer unique opportunities for self-directed, informal learning, and the potential to study, and learn at the user’s own pace.

5. THEMATIC TYPOGRAPHY OF VIRTUAL MUSEUM’S

This section deals with the thematic typography of the different kinds of Virtual Museums but, while the rhizome of each type of Virtual Museum clearly draws on its physical counterpart, the discussion will elaborate not on the type *per se*, rather on the ways in which the Virtual Museum extends the museum mission in ways not possible before its digital footprint. Different kinds of museums are custodians of many
different kinds of collections.
This section discusses the different approaches that the museum takes when it reproduces its minute self as a Virtual Museum, not so much as a representation of its physical space, or even its material collections, but rather as an extension of its core mission and as an extended platform for the narratives that is spoken in the institutional voice.

5.1 THE ARCHAEOLOGICAL VIRTUAL MUSEUM
Archaeological Virtual Museums mobilise content to create new realities for the visitor. They are ideally designed to present the absent object using an electronic surrogate to replace the facsimile, or reproduction that was (and is still) placed in the gallery to complete the narrative. In addition, the critical information about the archaeological object as documented from excavations can be displayed alongside the geographically or chronologically separated artefact. Having said all this – while potentially the Virtual Museum can create a whole object or an entire site literally out of nothing – the line between reality and virtuality is a fine line to walk. Delineating what has been reproduced from what was the original object or building is critical in creating an accurate and meaningful narrative. This can be accomplished by marking the reconstructed from the excavated; the created from the fragments; the detail from the whole. Transparency and fidelity in the documentation, and display of the processes is the key to integrity of the action, and is critical to a project that aspires to accommodate the museum mission. The alternative to the fidelity of the archaeological Virtual Museum as described above would be in its becoming a simulacrum of itself. Baudrillard describes this is when,

the whole system becomes weightless, is no longer itself anything but a gigantic simulacrum – not unreal, but a simulation, that is to say never exchanged for the real, but exchanged for itself, in an uninterrupted circuit without reference or circumference (2000: 6).

Baudrillard deduces that simulation envelops the whole edifice of representation itself as a simulacrum and outlines the much-quoted successive phases of the image as:

It is the reflection of a profound reality;
It masks and denatures a profound reality;
It masks the absence of profound reality;
It has no relation to any reality whatsoever: it is its own pure simulacrum (ibid.: 6)

Having said this, even with the temptation of creating entire worlds, as for example in the 3D universe such as Second Life, the relation to the original must remain map-able, trace-able and reliable in order for the Virtual Museum to be trusted as a space of veracity and authenticity. Alternatively the simulacrum becomes meaningless, incompatible, and irrelevant to the museum mission.

5.2 THE ART MUSEUM / GALLERY VIRTUAL MUSEUM
In the art world there is far more freedom of expression than in a field rooted in archaeological or historical reality, but first we have to determine how we define an art Virtual Museum. Objects found in art Virtual Museums fall into one of two
categories: either they act as digital reproductions of physical art works, as found in typical material collection, or they can be described as novel creations that have been created by computerised or networked environments, as artefacts that have been born digital and remain as digital objects throughout their lifetime. In either case they inscribe within them something that causes us to recognise them as art; even if we might find a little more challenging when we encounter conceptual art that perhaps has been created out of found materials or whose only artistic gesture lies in a minimalistic gesture or a single paint blot.

In describing ‘wonder’ as a model for the exhibition of works of art, Professor of English, Stephen Greenblatt, recognizes the encounter between object and beholder in the museum context, and describes the power of the displayed object to stop the viewer in his or her tracks, to convey an arresting sense of uniqueness, to evoke an exalted attention (1991: 42). In describing this process, Greenblatt acknowledges not only the dialectic nature of the object, but also its precariousness, which, he claims, radiates a rich source of resonance (ibid.: 43), a perception that Walter Benjamin denoted the ‘aura’ (1992). Nothing conveys as accurate a conception of the genuine aura as van Gogh’s late paintings,’ Benjamin asserted, which could be described as all things painted with their accompanying aura. The auratic resonance is determined in part by the almost hallucinogenic setting of the object on the pedestal in the gallery and in part, through the ambiance of the museum design. The architectural space of the museum, together with the glass showcases and the spotlight pedestals, sets the stage for the encounter, and visitors who wander around the galleries cannot help but be awed by the lavishness and splendour around them.

The museum can also be conceptualised in its role as treasure house, where objects of wonder are staged on pedestals to bedazzle the visitor. This wonder has been described by Greenblatt, as the ‘cult of the marvellous,’ and by Alfred Gell as the ‘halo-effect’. The question here is clearly, whether these same qualities are just as evident when the Virtual Museum that contains immaterial or intangible works of art are essentially either a derivative of the original on a tiny screen, or an intangible art work that stands in direct opposition to the uniqueness of an art object that its relentlessly clone-able. There is clearly no clear-cut answer here, as the appreciation of art is highly subjective. Once art born-digital however, crosses the threshold of a physical museum, or is anchored in the museums’ website, it automatically received institutional recognition, and can be admitted to ‘the cannon’ whether it has been born-digital or not.

5.3 THE ETHNOGRAPHIC/ANTHROPOLOGY VIRTUAL MUSEUM

When discussing the representations of the lived culture of an ethnographic or anthropology museum, intangible heritage makes its screen debut almost seamlessly. Again we need to make a distinction here between the material objects of cultural heritage; masks, musical instruments and ritual artefacts, etc., and those expression of cultural heritage that include, according to the UNESCO definition; traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.16
One of the vexing challenges of anthropology museums in a postcolonial era is how objects and traditions have become separated from their origins; with collections residing in storerooms in museums around the world, far away from the people who created them and who perhaps know as much about their uses and traditions than the curator or specialist who manages them in the museum. The Virtual Museum in this case has a critical role to play and we are now seeing more and more collections appearing online, with museums eager to renew connections between the collection and its ancestral owners. One such network was launched in March 2010, The Reciprocal Research Network (RRN), initiated by along with the Museum of Anthropology (MOA) at the University of British Columbia as well as a dozen museums that also participated in the development process including the Pitt Rivers Museum, Oxford. Diverse user groups, including indigenous communities, now share their own perspectives and knowledge with the people and institutions that make up the RRN community and new conversations and synergies are already evolving around the collections.

With anthropological museums now bringing their holdings online, such as the Penn Museum of Archaeology with their newly launched Anthropology Online Collections Database, new possibilities for networking and a sharing of situated knowledge are growing every day. The Penn Museum’s collections, of around one million objects were collected directly through their own field excavations or anthropological research since the institution was founded in 1887. Today you can search the digital collections that include some 326,000 records representing 660,000 objects with 51,500 images searching by keyword, curatorial section, and type of material.

5.4 THE HISTORICAL VIRTUAL MUSEUM

Local history museums tend to house a range of objects that at first glance don’t appear to have significant monetary value, and probably exist in the basement of your home and mine. Brought together in sequential presentations however, these often banal objects serve to punctuate local stories with the physical evidence that serves to tell the real story, and produce, in this way, a convincing historical narrative with a visual imperative. Elevated to museum status and spotlight in the gallery, however, these kinds of benign objects take on new qualities when mobilised in the gallery.

According to Michel Foucault, (1994) social space has been moving towards de-sacralization since the time of Galileo when he describes a hierarchy of sacred and profane spaces. In order to fulfill this desire for the sacred, contemporary society seeks to define spaces, separate from mundane, everyday living. Foucault describes these spaces as utopias, as spaces having no real place, as fundamentally and essentially unreal; although acting as an analogy with the real space of society. According to Foucault, every civilization creates real places, actual places, that serve to stage experiences and consequently sets them aside for extraordinary action. The liminal spaces, that Foucault calls heterotopias, while based in objective reality, act as the mirror that reflects. While this reflected space may be concrete, in that it exists in a real location, it’s social function, at the same time serves to provide society with an abstract locale. A derivation of the heterotopian space, according to Foucault are the heterochronias of time that accumulates indefinitely - for example, museums and libraries.
Museums and libraries are heterotopias in which time never ceases to pile up and perch on its own summit, whereas in the seventeenth century, and up to the end of the seventeenth century still, museums were the expression of an individual choice. By contrast, the idea of accumulating every-thing, the idea of constituting a sort of general archive, the desire to contain all times, all ages, all forms, all tastes in one place, the idea of constituting a place of all times that is itself outside time and protected from its erosion, the project of thus organizing a kind of perpetual and indefinite accumulation of time in a place that will nor move - well, in fact, all of this belongs to our modernity (Ibid. 1964).

Foucault argues that the museum is already an exceptional space, set aside by society for extraordinary activity, but how do these un-extraordinary objects work to tell their story in the historical Virtual Museum? The display of sequential objects once re-contextualised in the historical Virtual Museum serve to enact the meta-narratives of the institution of the museum; the national story, the community history, or the local-narratives; just in the same way as they do in the physical museum. Notably it is the material objects themselves that are highly persuasive in the telling of the story, as if to say – we are the physical evidence, you cannot dispute our claim! The mobilized objects all come together to produce a convincing story line which at times can present a particular historical practice as exotic, while at other time they can be staged almost as alien. When ‘normative’ displays of ‘our’ heritage, create ‘our’ shared memory, this often refer to some members of society, but not all museum visitors will necessarily concur with this message. Visitors who comply with the story line will readily engage with the narrative; alternatively, the exhibition message may be read in opposition, while at other times visitors may simply react indifferently.

In a world that dances to the tune of Web 2.0 there is little space left to tell stories of all communities in the physical museum, and it is often far too complicated – and prohibitively expensive – to find, and exhibit appropriate objects that can tell everyone’s story. In much the same way that the anthropology museum is opening up new ways to connect objects to their distant communities, so historical Virtual Museums can serve to introduce a range of micro-narratives that can tell stories from more than one perspective that can be driven by the users themselves. In this ways scenarios can be devised to bring all users into the storyline and allow a multiplicity of voices to be present in the narrative.

5.5 SCIENCE AND NATURAL HISTORY VIRTUAL MUSEUM

In science and natural history museums, abstract scientific progressions are presented through displays of the physical evidence of these processes. Science museums may display historical instruments, vehicles, or laboratory equipment to mark significant moments in the history of science, while at the same time ready-made materials, objects bought at a local shop or factory may be integrated into the display to demonstrate scientific processes. Natural history museums exhibit their own stories; laying out shelves of fossilised bones, stuffed animals, or live specimens in aquaria; all serving to inject a more convincing quality into the gallery narrative. The equivalent Virtual Museum’s follow these scenarios in the virtual with the added advantage of making visual vast quantities of data and information by making their databases of the collections available to all.

Searching through these databases using keyword searches ensures that only relevant objects are retrieved, using indexes, taxonomies and thesauri. The thesauri and taxonomies are written into the structure of the platform and serve to facilitate intuitive searches. Managing large databases in this way, ensures that the
entire holding of the collection can be made available to all, and through this direct accessibility, wrenches proprietary of scientific knowledge from the scientist; relinquishing it directly into the public realm for you and I to study and enjoy.

A recent discovery at the London-based British Geological Survey\textsuperscript{21} shook up current knowledge when a set of specimens was \textit{re-discovered} unexpectedly. These were not ordinary specimens; rather a set of slides that had been collected and prepared by Charles Darwin during his famous expedition on the HMS Beagle.

\textit{A ‘treasure trove’ of fossils including plant specimens collected by Charles Darwin, have been rediscovered. The fossils, which have been ‘lost’ for 165 years, were unearthed in an old cabinet at the British Geological Survey’s vast fossil collection. They have now been registered and photographed and are available for viewing by the public through a new online museum exhibit released today:}

Dr. Howard Falcon-Lang, a palaeontologist at Royal Holloway, University of London, made the discovery. He explains…

\textit{While searching a cabinet for fossils from the Bristol Coalfield, I spotted some drawers marked ‘unregistered fossil plants’. I can’t resist a mystery, so I pulled one open. What I found inside made my jaw drop.}

Placing the newly discovered find from 1846 directly into the public domain over the online Virtual Museum meant that the prototaxites specimens – 400 million-year-old tree-sized fungi – could instantly be evaluated by almost everyone in the world. The story is a bizarre one but it does reinforce the sense that once a collection has been correctly collated according to its taxonomic logic and once released for all to study, nothing can be lost; unless of course the resources in the database are mismanaged, or alternatively if someone has turned the electricity off.

6. VIRTUAL MUSEUM SCENARIOS

The following section describes the kinds of delivery mechanisms that are used by producers of Virtual Museums. Each kind of delivery, as well as the scale of delivery all affects the quality of end-user experience. Sitting in a darkened theatre, walking around a fully immersive space or holding a tiny micro-museum in the palm of you hand, produces totally different kinds of interactions, expectations and possibilities. The following section breaks down the delivery mechanisms into measures of scale, and describes the different kinds of experience that can be enacted in each space.

6.1 SCENARIO 1: THE WEB-BASED VIRTUAL MUSEUM, THE UNIQUE MUSEUM

Perhaps the most obvious form of Virtual Museum is the one that represents the singular, physical museum. This section describes how a bricks and mortar museums project themselves online, as a stand-alone production, or as a mini-museum over mobile networks. The typical institutional museum website would in-
include information visitors need to prepare for their visit; ticket sales, exhibition promotions, opening hours, etc. Where once this kind of information was only available on printed publications – brochures and marketing pamphlets – museums are now expected to publish their information online. As collections were digitised for internal management purposes, they too could be presented to the public in study rooms and on screens in the gallery in modified formats, offering the same kind of information and images as in the printed catalogues. Pre-visit information and educational activities evolved on the institutional website; introducing the exhibition even before the visitor has left his home or posting visit activities that extend and augment the visit, adding a further dimension to the experience.

A Virtual Museum, as standard museum practice does not seek to either displace or distract from the museum mission, to collect, display, and interpret the material collections for the visitor. Rather, it serves to enhance and extend the museum mandate in novel ways, and even open up new possibilities as the discussions above described. A typically museum will now not only have to invest in a comprehensive institutional website, but will also need to have a robust Web 2.0 presence (i.e. on Facebook, Twitter and YouTube). Many museums are now investing in apps over mobile platforms while developing audio guides for visitors in the museum.

The kinds of environments the museum will be producing – either developed and maintained in-house or outsourced to commercial vendors – will typically include a calendar of lectures and gallery talks, educational resources for schools and higher learning, virtual tours of exhibitions, and opportunities for the public to interact with the museum over social networks. Museums that publish their holdings online – as collections or mini-sites of exhibitions are often described as deep silos whose holdings are too many clicks away from search engines and the causal browser who might not know where to go to look for a particular art work or specialised collections, or might not even know the right expressions to be able to search for content in the professional language that is shared by curators and scientists. Pooling resources across shared portals over online collaborations can greatly increase the museum’s profile, and through working with sister institutions over fraternal networks can greatly increase the visibility of the unique museum. The following section will describe such aggregations of content and will introduce two case studies to describe the advantages of such collaborations.

6.2 SCENARIO 2: THE WEB-BASED VIRTUAL MUSEUM, AGGREGATORS, PORTALS & LARGE SCALE COLLABORATIONS

Bringing similar museums into a satellite of fraternal institutions hold several advantages for the unique museum – the most obvious the national portal. According to Samuel Jones …

*National institutions provide a logic to the cultural realm, providing paradigms of excellence, representation to different cultural forms and a framework for the delivery of capabilities, either by their own practice, or by supporting smaller institutions through providing additional representation to their work, programmes of collaboration or loans and, in many cases, resource provision that already exist (Samuel Jones, Culture Shock P. 20).*
The expected success of these kinds of collaborations is premised on both the aggregation of content, as well as on the interoperability of individual systems. Once portals open up the distributed collections of geographically dispersed institutions under the umbrella of national portal, if communication (interface/interaction design) is successfully studied, users have more opportunities to discover what they are looking for and even to discover content they didn’t even know existed. On one level the national portal can be conceptualised as a vast encyclopedia of freely accessible knowledge while at the same time they can be viewed as a travel brochure for incoming tourism. Information is coupled with knowledge; and when accessed from anywhere in the world can act as windows that open up directly to the collections; the exhibitions and the range of services that museums now offer their public. It follows some examples:

Google Art Project and Europeana: background

While both the Google Art Project and Europeana deliver cultural content, these two projects have very distinct yet very different visions, and consequently offer diverse user experiences. Europeana has been developed as the gateway to Europe’s distributed cultural heritage resources. Content is drawn from 27 member states, and includes books, maps, recordings, photographs, archival documents, paintings and films from national libraries, museums and galleries, archives, libraries, audio-visual collections, and cultural institutions. The European Digital Library currently points to more than 20 million objects from over 15,000 institutions across Europe. None of the collections, however, are actually held by Europeana. Ironically this prestigious library, with a recognizable brand does not act as the custodian to these collections, hosting within the portal only a thumbnail preview and the metadata; the textural explanations that describe the objects, or works of art. Through browsing and searching on Europeana, and after discovering the collections, the user is taken out of Europeana to the distributed institutions where the content resides.

However, this library is a truly European library. With the aim of providing multilingual access to Europe’s diverse cultural heritage, Europeana currently is available in all 23 official EU languages.

The Google Art Project is an entirely different kind of portal. This ambitious project grew out of Google’s 20% policy offering their engineers “20-percent time” to work on what they are really passionate about. The Google Art Project invites users to explore museums from around the world, and to view a selection of their collections at high resolution. At the time of writing there are more than a thousand artworks online, with 17 museums taking part in this project.

The three main features to the Google Art Project include:

- A walk-through of the physical galleries using their Street View technology
- The Artwork View, where a single work of art, selected by each museum is offered in high resolution. This is called the Gigapixel Artwork (7 billion pixels), where visitors can zoom into the image and view it over a platform that ‘tiles’ the work behind the scenes; delivering the breathtaking images tile by tile, almost in microscopic detail.
- A shopping cart/lightbox feature that allows users to select from across the artworks and to bring
them together into their own, personalized, collection.

Each museum has its own section, including a link to museum’s homepage, and a comprehensive floor plan, with a number of galleries highlighted that link to the other artworks selected in the project. This is the Street View route and we move around the galleries as if we are perched on the shoulders of the driver as he winds his way around the galleries at just the right height to catch the paintings and sculptures. This is the magic of the Google Art Project, the sense that we are actually wandering around a real museum and viewing the collections from the best perspective.

Europeana clearly delivers an impressive range of objects, but what about that intangibly vague quality that can best be described as the *[wondrous]* quality of the object? Can either of these websites deliver anything to convey the auratic quality of the art as discussed above? The Google Art Project does offer some measure of the ‘wow factor’. The images are gorgeous and it is fun to be able to ‘drive’ through the galleries and enjoy the art. The ‘wow’ factor with Europeana lies in the sheer quantity of rich content that lies at our fingertips, and even if you do need to click onto the next link to reach the full record and images, searching can be stimulating and rewarding. In both cases, the reward lies also in the textural records, and in the descriptions and narratives that are so intuitively accessible. Just knowing where to find the artwork or object and being able to find out about the treasures of so many Europeana countries is truly a daunting experience.

### 6.3 SCENARIO 3: THE VIRTUAL MUSEUM IN SITU (LARGE SCREEN IN THEATRE)

As noted above, the immaterial aspect of a Virtual Museum seems to stand in direct opposition to the mission of the museum and its commitment to the original and unique objects in their collection. However, the frequent use of the large screen, located both inside museums and in permanent or temporary locations around the world, means that content can be exported and these inspirational experiences can be shared with new audiences beyond the museum walls. The impact of the large screen in a dedicated theatre not only creates engaging content that extends the narrative with cinematic qualities but also add additional layers of information that are too complex to convey in wall texts, labels or other brochures. Here again there are many different kinds of cinematic interpretations of Virtual Museums, just as there many different genres of cinema. The most persuasive of these kinds of Virtual Museums is when they become immersive, and propel the audience to other places and other times according to the internal logic of the narrative.

Managing such a scenario is challenging as many such environments need to be driven, and most often (but not always) there has to be a single ‘driver’ navigating through the space for the benefit of the audience sitting in the darkened theatre. In a small space, such as a CAVE 26 there may be a limitation on the number of people participating in the Virtual Museum and especially when 3D glasses are used to enhance the experience with an additional layer of reality, there can only be one true perspective; that of the driver while other participants track the Virtual Museum from the driver’s unique perspective. In spite of all these challenges, many 3D, immersive Virtual Museums are being delivered with great success and are always enthusiastically received by audiences wherever they are located.
Narratives that have been developed for these kinds of Virtual Museums include the visualisation of scientific data (either streamed in real-time or pre-recorded), simulations of historical periods, born digital art, and archaeological reconstructions. Once released from the boundaries of the material object and physical space, these kinds of Virtual Museums open up persuasive scenarios that can be extremely compelling.

6.4 SCENARIO 4: THE VIRTUAL MUSEUM IN SITU (SMALL SCREEN IN THE GALLERY)

Bricks and mortar museums often introduce PCs as opportunities to extend the narrative, or augment the collection in the gallery; or just next to the gallery at a distance from the original objects. These kinds of information stations, study centres, and interactive kiosks supplement the collections; adding extra dimensions to the story line behind the works and objects. Often the mini reproduction of an exhibition; or even an entire museum is portable outside of the museum on a DVD that can be purchased in the museum shop and enjoyed away from the physical space and material collections it represents. Over recent years, CD and DVD platforms are becoming less and less popular, replaced by online access or more recently by cloud storage offered by numerous companies; often for free. The downsizing of the gallery and object on the small screen evokes an exhibition catalogue, more than it does the real works, but in this way the Virtual Museum is able to encapsulate the experiences, objects and narrative, maintaining the envelope of the exhibition and the integrity of the collections.

Where once the museum study centre was the only way to obtain extended information about a museum collection, pending the resolutions of copyright issues museums now prefer to disseminate this kind of information online or over mobile networks; releasing it from the institutional boundary of the physical space and reaching out to populations in their own workspace.

6.5 SCENARIO 5: THE MOBILE VIRTUAL MUSEUM

In 2011 the American Association of Museums commissioned a survey to evaluate the use of mobile technology in museums and the attitudes that museum professionals have towards mobile technology. They relate that in 2011 some 42% AAM member museums offered mobile technology experiences for their visitors/users while and one third of the museums planned to introduce some new mobile technology platform(s) in 2011. The survey however, did note how the majority of mobile technology in museums today is still audio only. Emerging mobile technologies, such as Smartphone apps and multimedia (including augmented reality, QR codes, etc.), are present in less than one in twenty museums.

This is probably one of the most promising of arenas for Virtual Museums. Smart phones and tablets are now becoming ubiquitous, and the range of experiences available through the various built-in functions enable all kinds of innovative interactions – see the range of museums apps now on the market in the appendix.
7. NARRATIVES AND VIRTUAL MUSEUMS

7.1 ON CLASSIFYING NARRATIVE

The earliest attempt to formalize narrative basics comes from Aristotle’s scheme on Greek tragedy (Aristotle, *Poetics* VII). Rather than a set of rules, Aristotle provided a description of the ‘state of the art’ related to myth and tragedy, stressing *unity of action* (i.e. continuous plot development, focused on the same protagonist) as the basic condition of narrative. During the Renaissance this observation was re-interpreted and expanded beyond Aristotle’s vision to become the *theory* of the three units (*time, space and action*).

Today, however, the definition does not seem at all sufficient as a basis for classifying modern storytelling. Moreover, Greek tragedy is but a small part of the whole corpus of narrative creations that have been produced across human history. For example, Antinucci’s analysis (Antinucci, 2011) dates back to Palaeolithic rock paintings and engravings and the earliest examples of reality ‘reproduction’ (it is really a re-production, as at that time people were not conceptually aware of the difference between art as a tool to re-create real things and as a narrative representation of absent elements).

In modern times, narrative continues to evolve. Unity of action and/or time and space has been overcome both by modern literature (at least since the end of 19th century) and by the movie industry. And technological advances continue to introduce new storytelling possibilities. C. H. Miller (2008) considers *non-linearity* as one of the typical traits of storytelling in the digital era (the second trait is *interaction*). Perhaps the most relevant analysis on the topic has been conducted using the structuralist approach. For our purposes we do not need to go into great depth in this area, but it is worthwhile to check which parts of those works may be useful when considering virtual museums.

Classifications made by structuralists such as Propp and Todorov (Propp 1928, Todorov 1970) are limited to particular categories (such as the *tale*, or the *fantastic*). Others, such as Bachtin and Segre (Bachtin 1973, Segre 1985), have defined schemes that remain suitable for modern storytelling classification yet they are affected by the same problem that besets all traditional analytical approaches to narrative: on the one hand, they mainly refer to it as verbal phenomenon, which is too limiting for our purposes 28, and on the other they lack the non-linearity (or multi-linearity) dimension of modern digital storytelling.

This brings us to an impasse, as there seems to be no way to formalize any scheme on a narrative dimension, which may be, by definition, non-linear or multi-linear. The only possible approach is to consider storytelling structures as variously shaped groups of elementary narrative ‘units’, which can be arbitrarily assembled to create many different narrative patterns (uni-linear, multi-linear, etc.). Thus we have made this our goal. We have reviewed narrative theorists and identified a narrative schema for virtual museums that contains at its core such a narrative ‘unit’.
In the following pages we suggest that this narrative ‘unit’ contains a setting, an entity (i.e. a character, object or museum visitor/user) and an event or action. The event/action produces an outcome that changes the character and the museum visitor, thus advancing the story. The relationship between these elements and the surrounding components of narrative such as plot, narrator and genre are illustrated in Fig.1 below.

![Diagram of narrative structure]

Fig.1

The schema remains a work in progress and is likely to need testing and refinement, but it is presented here as the first step in understanding the nature of narrative in this rapidly evolving field.

7.1.1 When can a virtual museum be said to have a narrative?

Before we examine the components of narrative, it is necessary to ask a fundamental question: do all virtual museums have a narrative? For example, does a collection of digital images or a set of simple descriptive labels contain a narrative? Does a website that displays such items contain a narrative? If such digital objects and information about a single era, people, place object or theme are presented as a collection, can it be said to have a narrative? Throughout this section we will describe narrative as a chain of basic interconnected ‘units’; a sort of ‘path’ linking together events, characters, objects and users.

A narrative implies the presence of a sequence. It may not be linear or rigid (it may have a degree of freedom, as in a videogame) but it is an experience in which the user (either actively or passively) passes through a series of steps, whose different combinations have been previously designed as logical paths aimed at creating an emotional and cognitive experience.
This sequence, these interconnected units, make sense to us as a story. They have narrative coherence. In contrast, a collection of digital pictures or a set of simple descriptive label files do not contain a ‘path.’ While they have thematic coherence, they do not have narrative coherence. They do not contain a narrative. This leads us to reconsider the definition of a Virtual Museum. As a matter of fact, the term "virtual museum" may be said to have at least three meanings:

1. Virtual Museum: the use of any digital device for supporting cultural heritage dissemination
2. Virtual Museum: any digital application, which implies the presence of virtual reality (i.e. models of cultural heritage objects).

And most meaningfully, a definition that stresses the deep power of virtual reality to (re)assemble elements in different logical configurations:

3. Virtual Museum: any use of digital devices for supporting CH dissemination through the building of emotional and cognitive paths to link elements to each other.

It is this last definition that we consider to contain narrative.

7.2. DEFINING THE NARRATIVE ‘UNIT’

An analysis of movie structure done by Casetti and Di Chio (1990) suggests that narrative is a chain of situations in which events occur and where characters move in specific environments. Considering this definition, we can isolate three basic elements of a narrative as:

1) ... somebody ...
2) ... who makes something happen (or to whom something happens) ...
3) ... leading to a change of the situation.

For our purposes, we can reframe these elements as:
1) agent
2) event/action
3) change

The most basic ‘unit’ of narration, then, includes an elementary sequence of events. It seems reasonable, for our goals, to consider a narrative as a chain of these events each defined as a whole of: agent, event, change. This approach ties in with Abbott’s theory and definition of narrative (2008). He suggests that it is ‘the representation of an event or series of events’ made up of two components: story and narrative
discourse.

Story is the chronological sequence of events involving entities, i.e. characters and/or objects. This corresponds to our agent-event-change formulation. Narrative discourse is the story told, or narrated, i.e. the story as rendered in a particular narrative, from a specific point of view, with a specific plot structure, possibly a narrator and perhaps adhering to certain genre conventions, etc. To use a common phrase, story and narrative discourse can be viewed as ‘two sides of the same coin.’

Such a schema fits with virtual museum narratives, with some adjustments and additions. To explore these we will examine each component in more detail.

7.2.1 on agents and entities

In Abbott’s ontology, entities include characters (humanlike entities capable of agency) and objects (insentient items incapable of action on their own but about which a story can be told). For our purposes, the inclusion of insentient objects is crucial as in a virtual museum an artefact or collection of artefacts may be the focal point of any narrative. However there is also another element to consider. As noted by Miller, interaction is a fundamental trait of digital storytelling. Within an interactive narrative, it may be a user rather than a character that experiences the event/action and change. Thus we must also add a third component when considering virtual museum narratives – the visitor or user. Consequently we can better define the agent as a whole made of three symbiotic elements:

1) the virtual museum user
2) the characters (i.e. all the living or animate elements of the Virtual Museum who are able to give a feedback to user’s or other character’s actions)
3) the objects (i.e. all the inanimate artefacts of the Virtual Museum, which are the focus of user’s or
As we are considering animate and inanimate elements, it is perhaps more appropriate to use the term *entity* rather than *agent*. Thus we expand our schema (Fig.3).

For further exploration of character types in virtual museums, see below “Character types in virtual museums”.

### 7.2.2 on event/action and change

The element that moves action forward within the narrative unit is the *event*. It leads to a change that in turn triggers another event/action. To define and classify the concept of event/action and change, it is useful to consider McKee’s analysis on the narrative structure of film. McKee (1998) argues that the key component of film narrative is the *story event*, which *creates meaningful change in the life situation of a character that is expressed and experienced in terms of value and achieved through conflict*.

By *values*, McKee means *universal qualities of human existence that may shift from positive to negative, or negative to positive*. He cites a wide range of examples including truth/lie, courage/cowardice, love/hate, excitement/boredom, etc. The *conflict* referred to may be internal within a character (e.g. a personal belief versus a personal fear) or external (e.g. one character versus another, versus a group of characters, or versus societal or environmental forces). So, according to McKee, during a cinematic story event a character moves from one value to its opposite.

When describing or designing narratives for virtual museums, we can adopt McKee’s ideas and define an event as an incident that creates meaningful change in the life situation of a character, expressed and experienced in terms of value and achieved through conflict. However as with agents/entities, we must also consider the visitor/user. Within a virtual museum narrative, does any change occur in the user? We must look at the concept of interaction in some more detail to address this question.

We have already noted that Miller considers interaction to be one of the typical traits of digital storytelling.
In our WP2 work, we defined virtual museums as non-interactive and interactive: dealing on the one hand with a traditional multimedia narrative structure (the user is passive) and on the other with a new narrative dimension (closer to gaming applications).

When considering the features of a virtual museum narrative we must always remember that it is conditioned and influenced by the museum, that is to say it is not a general storytelling application on any subject, but a narrative specifically based on museum items (i.e. real or somehow existing objects). The virtual museum narrative function always has an educational goal, insofar as it aims to enrich the user’s knowledge or change his/her mindset. Consequently, the result of any Virtual Museum narrative necessarily involves the user.

So when considering a virtual museum narrative we can expand our earlier definition of action/event and change. It creates meaningful change in a) the life situation of a character, expressed and experienced in terms of value and achieved through conflict, and b) in the virtual museum user, who acquires knowledge, or a changed mindset, based on what has occurred.

7.2.3 on arena / setting

All the elements we have considered so far: characters, users, objects, action/events and change exist, or take place within, a narrative environment. This environment is variously referred to as the storyworld (Abbott 2008), setting (Abrams 2012) or arena (Truby 2007). For our purposes we propose to use the term setting to define this component. The setting is composed of all the virtual elements representing the narrative world’s passive background. Unlike entities, the setting does not provide feedback to a user’s or characters actions.

As a result of the strong link between virtual museums and real life contexts, the setting must be in someway related to real (i.e. currently or previously existing) elements. For this reason we consider it of equal importance with events and entities and add it to our schema accordingly (fig. 4).

7.3. ADDITIONAL COMPONENTS OF NARRATIVE

As we have seen, narrative is made up not just of story but of narrative discourse also. Narrative discourse is the ‘story told.’ The maxim that there are ‘two sides to every story’ illustrates the concept well; while a
narrative has only one set of events, these can be presented in multiple ways. It may be told in a linear, chronological way or using flashbacks, it may feature a narrator or not, it may adhere to certain genre conventions or not. Below we briefly examine the features of narrative discourse.

7.3.1 plot structures

The most fundamental and indeed the only mandatory component of narrative discourse is plot. McKee (1998) defines this as ‘the internally consistent, interrelated pattern of events that move through time to shape and design a story’. Abbott (2008) notes several varying definitions of the term, among them that it is ‘the order in which the story-events are arranged in the narrative’. For our purposes, we define plot to be the order in which narrative units are arranged. Narrative units may be assembled in many different shapes, lines and paths, creating complex structures with infinite possible results that differ from each other, above all in terms of linearity, that is to say, in the way they manage space/time dimensions along the narrative path.

The scholar who approached such dimensions in the deepest way is probably G. Genette (Genette 1972). While his analysis of the management of time-spans in literary texts is still a suitable way to classify many modern multimedia stories, the emergence of the digital domain suggests that we use the concept of linearity instead of time to classify differences in plot shaping. With that in mind, it seems more useful to sketch up a classification of narrative plot structures according to Miller’s elements of digital storytelling: interaction and (non) linearity. It is also useful to consider another area in which these ideas feature prominently: the world of game design.

Adams & Rollings (2006) identify three key ‘narrative structures’ within game design that are useful as we consider plotting in virtual museum narratives:

1. **linear**: in which one event follows another in a precise sequence and the user only has one path through the narrative
2. **branching**: in which there are multiple pathways through the narrative. Each pathway contains unique events. The user has multiple paths.
3. **foldback**: similar to a branching structure, however the plot is built around a number of key, inevitable events. Users have limited freedom to create their own path, but they are directed to key events at critical points.

Following on from the above, the International Game Developer’s Association noted two further classifications:

4. **threaded stories**: wherein ‘the course of the plot does not follow a single path […] rather, the story is comprised of a number of different threads that develop largely independently (at least until the closing stages of the story).
5. **dynamic, object-oriented narrative**: in which there are a number of episodes, each of which ‘consists of
a number of scenes which can use any structure – linear, branching, parallel path etc.’

7.3.2 narrators

The narrator is the one who tells the story. In literature, narrators are traditionally classified according to their point of view (Abrams 2012). Films and plays only rarely use narrators and instead typically rely on actors and other elements to communicate the story (Abbott 2008). A virtual museum narrative may use a narrator or it may, as in cinema or theatre, rely on other methods.

Here we note the main points of view and features thereof, according to Abrams:

1. **Third person, omniscient narrator**: a narrative in which the narrator knows everything that needs to be known about the agents, actions and events of a story. An omniscient third person narrator can also move freely in time and place and move from character to character to report speech, thoughts, etc. In most cases the third person, omniscient narrator is viewed as authoritative.

2. **Third person, limited narrator**: a narrative told in the third person but in which the narrator stays within the confines of what is experienced, thought and remembered by a single character.

3. **First person narrator**: a narrative that is limited to what the first person narrator knows, experiences, infers or finds by talking to other characters.

4. **Second person narrator**: a narrative in which the story is told solely, or at least primarily by the narrator to someone he calls by the second pronoun, ‘you’.

7.3.3 genres & narrative paradigms

A consideration of narrative discourse would not be complete without acknowledging the existence of genres, which we can also call narrative paradigms. The term genre denotes a type or class of narrative containing shared elements.

Since the time of Plato and Aristotle, scholars have sought to classify narratives according to sets of codes and conventions (Abrams 2012). Goethe, Schiller, Polti and Friedman are just some of those who have attempted systems of classification, yet debate continues as to the number and indeed the precise nature of genre. Barthes noted that ‘narrative is first and foremost a prodigious variety of genres’ and listed myth, legend, fable, tale, novella, epic, history, tragedy and comedy as just some examples of discrete genres. In film, the list of genres and subgenres is lengthy. Any comprehensive list might include the love story, the horror film, the western, war stories, the coming-of-age story, crime, historical drama, sci-fi, fantasy…and many more. The list goes on (McKee 1998).
Literary genres and narrative paradigms in film are useful to us as we consider narrative discourse as they reveal a set of codes and conventions that exist implicitly between writer and reader, filmmaker and viewer. When we sit down to read or watch a tragedy, comedy or horror, we expect to encounter certain types of characters and events and even experience certain types of emotions.

It would be useful to examine a number of popular literary and cinematic genres and paradigms, to examine which elements might be usefully employed in virtual museum narratives. Understanding the rules that govern genres and narrative paradigms may assist future virtual museum narrative designers in creating narratives that suit specific subjects or accomplish specific goals. More work needs to be done in this area. For the purpose of this deliverable, we include in Appendix 1 below an initial examination of some narrative paradigms that exist in film.

7.4. SUMMARY: THE NARRATIVE SCHEMA

We have identified the narrative unit as being made up of entity-event-setting. We have charted the location of a number of additional elements that exist around this basic unit, namely story, narrative discourse, plot, narrators and genre/narrative paradigms. The full schema, with short explanations, can be seen in fig. 5 below.

This schema serves as the basis for creating narratives for virtual museums. With further discussion and study, we submit that it can form part of a supporting tool-set that can be used when creating and scriptwriting virtual museum narratives.
Narrative: The representation of an event or series of events. A narrative has two components: story and narrative discourse (Abbott, 2008).

Story: A story is a chronological sequence of events involving entities. It is "the temporal order of what happens" (Abrams, 2012). Stories exist independently of narrative presentation. In other words, the same story can be narrated in more than one way.

Narrative discourse: This is the story as narrated, i.e. the story as rendered in a particular narrative. The only mandatory element of narrative discourse is plot. Many other elements including narrator, genre, etc. may be used, but none has to be present.

Setting (aka 'arena' or 'storyworld'): The environment where the action takes place.

Event: A fundamental unit of action that leads to change in a) the entity and b) the VM user's knowledge/mentality.

Entity: Entities are all the virtual living elements of a VM narrative who are able to give feedback to a user or other characters, and all objects which are the subject of action within the narrative.

Plot: The internally consistent, interrelated pattern of events that move through time to shape and design a story (McKee 1998). Plot is the order in which narrative units are arranged. It can be linear, branching, foldback, threaded, dynamic.

(Narrator(s)): 1st person, 2nd person, 3rd person omniscient, 3rd person limited, etc.

Genre/Narrative Paradigm: A type or class of narrative containing shared elements. There are many types. Examples include myth, legend, fairytale, novel, short story, ballad, horror, comedy, sci-fi, western, etc.

Optional

Users: Real people (museum visitors) capable of agency within the narrative.

Characters: Human or humanlike entities capable of agency within the narrative.

Objects: Inertant items incapable of agency, but around which events/interaction may take place. For example, an artifact around which a story might be told, for example.
7.5. NARRATIVE PARADIGMS IN FILM

When looking for narrative styles in media outside the virtual museum domain, it makes sense to have a closer look at the art form that has a bigger audience than any other art: film. In film, there are many different genres with their own narrative techniques and traditions, often connected to national cinemas during certain time periods. Some important examples are German Expressionism, Soviet Socialist Realism, Italian Neo-realism and the French New Wave. For the sake of this deliverable, we have identified two widespread narrative “paradigms” that can provide knowledge and inspiration for Virtual Museum narratives: Hollywood film and art film. These two film-making paradigms have a big impact on our perception of narratives and to some extent constitute an interesting dichotomy with regards to how they tell their stories. Finally, we give a short presentation of two narrative styles not belonging to the western cultural hegemony whose popularity is constantly growing.

Hollywood film

Classical Hollywood cinema, or the classical Hollywood narrative, progresses always through psychological motivation, often in the shape of a character struggling to reach a defined goal. The plot is usually composed of two lines of action: A romance intertwined with a more generic one such as business or the solving of a crime. The characters are typically the causal agents of these lines of actions, being active, goal-oriented and equipped with clearly definable traits.

One fundamental principle of classical Hollywood cinema is the "invisible style”, i.e. the idea that formal properties as camera movements, editing, and setting should never call attention to themselves (Bordwell, Staiger, & Thompson, 1985). Invisible style is easiest to define by its opposites: the hand-held camera movements in The Blair Witch Project (1999) or the jump-cuts in Breathless (1960), are not invisible style. Time in classical Hollywood film is always linear, since non-linearity calls attention to the medium itself. The only exception to this rule is the use of flashbacks, e.g. to introduce a memory sequence of a character.

This smooth transition of time and space is by achieved with so-called continuity editing, which smoothes over the inherent discontinuity of the editing process and establishes a logical coherence between shots. One of the most important techniques to assure continuity is match on action, which can preserve temporal continuity where there is a uniform physical motion within a passage. A match on action is when some action occurring before the temporally questionable cut is picked up where the cut left it by the shot immediately following. For example, a shot of a character lifting a coffee cup is followed by second shot from another angle that picks up the movement from the first shot to maintain temporal continuity.

The classical Hollywood cinema was followed by a period called New Hollywood, sometimes referred to as the "American New Wave". This was a period that emphasized realism, focusing on matters such as anti-establishment political themes and sexual freedom. These themes and others were prominent in three of the most significant films of this period: Bonnie and Clyde (1967), Chinatown (1974) and Taxi Driver (1976). The narrative style of New Hollywood films differed from the straightforward narration of the classical period.
According to Berliner (2010), the narratives of films from the New Hollywood period are built on five principles:

1. New Hollywood films show a perverse tendency to integrate, in narratively incidental ways, story information and stylistic devices counterproductive to the films’ overt and essential narrative purposes.
2. The New Hollywood filmmakers often situate their filmmaking practices in between those of classical Hollywood and those of European and Asian art cinema.
4. New Hollywood narratives place an uncommon emphasis on irresolution, particularly at the moment of climax or in epilogues, when more conventional Hollywood films busy themselves tying up loose ends.
5. The New Hollywood cinema hinders narrative linearity and momentum and scuttles its potential to generate suspense and excitement.

After a number of box-office failures in the early 80’s, the film studios took back control from the New Hollywood filmmakers. This was the beginning of a new commercial paradigm that actually had started several years before with the enormous success of *Jaws* (1975) and *Star Wars* (1977). This new way of film making used tie-in merchandise, soundtracks and sequels, all for the purpose of creating block-busters with reliable return-on-investment. Another important component was the introduction of high concept narratives, i.e. making the film easy to sell to a wide audience by basing it on an easy-to-grasp idea. Three examples of successful high concept films are *Top Gun* (1986), *Jurassic Park* (1993) and *Godzilla* (1998).

According to Kaire (2012), high concept is comprised of five requirements, each of which is mandatory:

- The premise should be original and unique
- The story has to have mass audience appeal
- The pitch of the film has to be story specific
- The potential is obvious
- The pitch should be one to three sentences long

Art film

Art film has been defined as a "...canon of films and those formal qualities that mark them as different from mainstream Hollywood films" (Wilinsky, 2001). The narrative style of art film differs largely from the Classical Hollywood narrative. According to Bordwell (1979) "...the art cinema motivates its narrative by two principles: realism and authorial expressivity." The latter principle has its roots in the so-called auteur theory, which states that the director’s personal vision is the major creative force behind a film. Ingmar Bergman, Federico Fellini and Akira Kurosawa are considered to be some of the foremost auteur directors.

A central characteristic in the narrative structures of many art films is "...loosening of the chain of cause and effect" (Bordwell, 1979). Frequent character development and an exploration of ideas plays a more
important role than the film’s story. This is often the case in the films of Michelangelo Antonioni, for example, which explore the anxiety, boredom and flawed communication in people seemingly lost in modernist cityscapes.

Furthermore, art films often deal with inner drama, i.e. what is happening inside the character’s psyche. A very illustrative example of this is the *homo viator*, the inner trip, made by the protagonist of Ingmar Bergman’s *Wild Strawberries* (1957) in parallel with his physical trip through summer Sweden. It should be said that also (Hollywood) mainstream films address psychological issues connected to for example morals and identity. However, these issues are typically resolved in the end to achieve *catharsis*, i.e. the “emotional cleansing” occurring for one or more of the film’s characters as well as the audience. Overall, the concept of “tying all the knots together” in the end is much stronger in mainstream films. Art films often denies the viewers answers to all the questions, instead making them think about “...how is the story being told? Why tell the story in this way?” (Helminski, 2000).

**Other narrative paradigms**

There are other narrative paradigms. Examples are Bollywood and Anime.

Bollywood, the Indian film industry centred in Bombay, is the world’s largest film industry. Bollywood films have developed a very distinct narrative style that might seem unstructured and unrealistic to a western audience used to the narrative conventions of Hollywood film. As described above, Hollywood films tend to be action-driven, focusing on events and the changes following upon these events. In Bollywood films the story to a large extent focuses on music, typically in the shape of song-and-dance numbers, that bind together the events of the film. Even though these song-and-dance numbers can be considered unrealistic, often breaking both temporal and spatial continuity, they play an important role for the film’s narrative structure, for example by elaborating upon character motives or emotions. Lately, the Bollywood narrative style has started to have an impact on Hollywood style films, e.g. *The Guru* (2002) and *Slumdog Millionaire* (2008).

*Anime*, or Japanese animated cartoons, is another paradigm worthy of examination. Interest in it has grown steadily over the last 20 years, starting with the phenomenal success of Nintendo’s *Pokémon* franchise and its spin-off anime series. It is quite difficult to find a narrative discourse in common for all types of anime since there are so many genres. Nevertheless, it has been speculated that anime has some things in common with art film, in particular The French New Wave (SG New Wave, 2012). Just like FNW, anime tend to present itself in a youthful and rebellious manner by breaking conventional film rules. The result is a self-reflexive presentation style very different from the invisible style of Hollywood film. For example, a common anime convention is to frame shots in unusual ways, the purpose of which is not to add information to the plot but rather is purely aesthetic. Today anime has made significant impacts upon Western culture, which can be seen in *Toy Story 3* (2010) and *Kung Fu Panda* (2008), for example. The narrative conventions of anime should therefore be considered, especially when designing Virtual Museum narratives for younger users.
7.6 CHARACTER TYPES IN VIRTUAL MUSEUMS

We previously defined the agent as a result of user-arena-characters interaction. While here is not the right context to classify users, we may try a brief analysis of characters. Characters are the virtual living elements of the Virtual Museum, who/which are able to give a feedback to user’s or other character’s actions. In this sense the classification is valid for both interactive and non-interactive Virtual Museums. The aggregation of narrative units creates narrative structures made of one or more plots. As the common goal is the cognitive interaction with the user, a classification of character types may be drawn according to their relation with user’s (our) real world.

Characters live in user’s world (or in an undefined meta-historical dimension) and remember their world
In this scenario, character(s) exist in the user’s modern world. As such, dialogue between the user and the character is easily facilitated and characterisation can include powerful elements related to homesick and the romantic vision of a far, lost world. This type of scenario requires care to manage the justification of the character’s presence in our time. The issue of what they have done and where they have been in the interim must be addressed. Are they speaking from the afterlife? Did they return to life to tell us their story? These and other questions must be addressed to ensure the narrative is convincing and credible.

Characters live in their world but are aware of what is/will be happening in user’s world
This scenario contains a loss of realism and an increase in mysticism and fantasy. For example, characters could be dead people speaking (buried individuals, souls) or deities. Characters are typically omniscient, enabling them to refer to and perhaps even visit different historical times and events.

Characters live in their world and are not aware of user’s world
This scenario is more realistic than the previous ones outlined as characters exist only in their own world. They behave and react to events within their own environment.

However, this presents several challenges too. Designing the interaction between characters and users can be difficult, as they have very different backgrounds and levels of knowledge and experience. Also, one must be careful to ensure that characters do not display any knowledge of historical events outside their own experience.

Character’s and user’s worlds are contemporaneous.
Virtual museums are often viewed as only covering historical subjects and material. It is worth noting that a virtual museum may also cover a recent or even contemporaneous subjects and events, wherein the character’s world and user’s one are not in different time periods.

This doesn’t imply that there is no distance between their worlds, as distance may be in terms of different
thematic environments: for instance, in a virtual museum on aeronautics technology, the characters of a pilot or of an engineer may be contemporaneous with the user but living in a virtual world very far from his/her every-day experience.

Indeed in general terms some distance between user’s and characters’ world must exist. If they completely coincide, on the one hand there is no emotional tension and on the other, there can be no improvement in user knowledge or change in user mindset, thus, the virtual museum has no reason to exist.

8. THE VIRTUAL MUSEUM: CONCLUSIONS

After setting out all the variations and types of Virtual Museums there is still one category Virtual Museum that needs to be recognised – that of the total Virtual Museum – the Virtual Museum that is 100% virtual. This suggests a kind of Virtual Museum that does not exist in objective reality and its only essence is a totalising, electronic, simulation. An example of this kind of Virtual Museum is the MUVA, El Pais Virtual Museum of Art. This museum is a virtual fabrication, and maintains only a tenuous connection to reality. MUVA is built entirely in Flash to conjure up the 3D environment, where Director, Alicia Haber welcomes visitors to the museum, which specialises in contemporary Uruguayan and Latin American art, with an extensive collection of paintings by leading Uruguayan artists.

In order to build the physical national museum, four architects, Jaime Lores, Raul Nazur, Daniel Colominas and Marcelo Mezzottoni were commissioned to prepare the plans for the building on Avenida 18 de Julio, the main artery of Uruguay’s capital, Montevideo. They planned for a comprehensive fine arts museum, consisting of galleries for permanent and temporary exhibitions, as well as spaces for informal shows, a sculpture garden, restoration workshops, and administrative service areas. The building had five main floors but was never actually built as funding never came forward. In a moment of insight, Haber decided to go on with the plans for the national museum and decided to build it virtually. Some sixteen graphic and web-designers, programmers, photographers and system managers modelled textures of the walls, stairways, windows, sidewalks, roofs and elevator, pixel by pixel, to provide a sense of ‘reality’ for the visitors; a process that culminated in a much publicised launch in 1997.

Arguably, this Virtual Museum has, in fact, displaced – in this case a total museum – representing the national of Uruguay in its entirety when it became prohibitively expensive for the nation to build its own physical museum. At the same time, however, MUVA could not truly be said to represent the ‘displacement’ of the physical museum, for there never was, and there never might be a real museum. MUVA, meanwhile has gone on to, received many accolades over its lifetime, including many from within the museum community.
This report has tried to outline the wide range of experiences users can expect when they encounter a Virtual Museum and has attempted to describe the different kinds of platforms and expectations that all fall under the catchall term ‘virtual museum’. The following section is aimed to provide some practical guidelines and recommendations for those wishing to create their own Virtual Museum or for those who are simply interested in extending the discussion.

9. RECOMMENDATIONS

The following sections draws on prior research carried out and delivered by the V-MUST Network: V-MUST.net - Deliverable 2.1, delivered 30/06/2011, Terminology, Definitions and Types for Virtual Museums, and V-MUST.net - Deliverable 2.3 delivered 2/11/2011, State of the art on Virtual Museums in Europe and outside Europe, and V-MUST.net - Deliverable 2.4, delivered 30/09/2011, Methodologies, compatibility & re-usability. The discussion will not outline the specific technologies themselves – a comprehensive list of audio-visual technologies is available in Wikipedia while you can find a similar list of metadata standards in a similar Wikipedia page rather this section will focus on why standards are critical to the efficiency of Virtual Museums and how the choice of a technological solution can make or break a successful Virtual Museum.

Both technologies and standards are constantly being updated, and if solutions work at a certain time, there is no assurance that they are here to stay in the long run. Building and maintaining a Virtual Museum, therefore, can be predicated on a certain risk factor, and with even the best intent for long-term preservation of data, and the sustaining of the Virtual Museum is at the mercy of the flux of these kinds of changes that are outside of the control of any one institution or organisation. This section will also discuss the Virtual Museum in the context of a Web 2.0 world and will conclude with a series of steps that serve to think through the process of creating a Virtual Museum as a guideline for those who may wish to create their own Virtual Museum.

9.1 STANDARDS AND TECHNICAL RECOMMENDATIONS

One of the perennial jokes in the software developers’ industry is that there are an abundance of standards. This of course is not particularly helpful as end-users, and even the developers themselves need to be confident that their system functions seamlessly over different platforms. Only through adhering to common standards can the successful outcome of their programming be operable. Systems often need to work in more than one environment, and therefore need to be interoperable with other systems or environments. The only way to do this is to integrate and adhere to common standards at all levels.

Museums are aligned to both the archives and libraries communities in that there is a commitment to using terms that denote a specific idea that has been agreed to across the community. This has been
accomplished by using controlled vocabularies which act, exactly as it says in that they control the meanings the community intends when they use a certain term that can then be machine-read and therefore can be made explicit for the user. Once terms have been agreed upon they can be listed as taxonomies, creating structures of meaning that pertain to a specific intellectual area, or ontology. As terms become more structured, they branch out like trees, where each branch forms its own subset of meanings, getting more and more refined as the terms form their own conceptual space until an entire community of ideas are able to be expressed in agreed terms; each in its own set, subset and consecutive subset, forming a thesaurus that incorporates all the terms agreed upon by the community.

For a comprehensive discussion on standards we refer you to two Reports: V-MUST.net: WP3.2.1 Ontologies definition and cognitive technologies and V-MUST.net: WP3.3.2.4 Virtual Museums thesauri aggregation and implementation while this Report will consider the implications of adhering to standards and why they should be implemented into the Virtual Museum. The guidelines set out in the latter are based on documentation – Guidelines for the establishment and development of monolingual thesauri 33 which ensure consistent practice within a single indexing agency, or between different agencies (for example members of a network). These recommendations relate to monolingual thesauri, without reference to the special requirements of multilingual thesauri.

Perhaps the best-known classified thesaurus – Getty’s Art and Architecture Thesaurus – has been developed by the Getty Research Institute. 34 According to the website - the Getty vocabularies contain structured terminology for art, architecture, decorative arts and other material culture, archival materials, visual surrogates, and bibliographic materials. Compliant with international standards, they provide authoritative information for catalogers and researchers, and can be used to enhance access to databases and Web sites. The Getty Vocabularies grow through contributions. This is a resource that is used by many museums around the world but over recent years other thesauri have evolved as new domains of interest found a need to express their own local or specialised ontologies this resulted in solutions that integrate more than one thesaurus into their platform to support seamless searching.

Now that the community of Virtual Museum users extend across communities that use a range of languages, these terminologies have to be extended across more than one language. As the Semantic Web grows and controlled vocabularies enable deeper and wider search capabilities, new solutions are being developed to make collections visible, and accessible to people all over the world; whatever language they may speak 25. In the world of Semantic Web the goal is to link digital resources to others already available online. This initiative is called Linked Open Data (LOD) 36 and Europeana, for example, has already integrated these goals into their policy and pragmatic agenda. In the same way as we are able to link related documents online over simple web pages that are linked to one another, through the Semantic Web we are also able to link related data. The term Linked Data refers to a set of best practices for publishing and connecting structured data on the Web. According to the Linked Data website, the technologies that support Linked Data are URIs (a generic means to identify entities or concepts in the world), HTTP (a simple yet universal mechanism for retrieving resources, or descriptions of resources), and RDF (a generic graph-based data model with which to structure and link data that describes things in the world.)
These recent developments now open up content for Virtual Museums that not only connects to resources in ways not previously possible, but also make content accessible and visible through mechanisms that are machine readable even across language barriers.

9.2 RECOMMENDATIONS IN A WEB 2.0 WORLD

Through technologies such as YouTube or as a result of increased travel or migration, people can now access, encounter, create and share the products of cultural creation on a scale previously unimaginable, and regardless of the publicly funded cultural sector. This brings the different opinions expressed in such cultural production and activity into closer and more intense contact, which creates new challenges for society (Samuel Jones, *Culture Shock* P.12)

Over the first online decade when Virtual Museums were appearing, information was distributed through the broadcast model, where content was authored and published by the institutions themselves and delivered to many users across the web. Over recent years the web has become more participatory, and there are now many opportunities for individuals, in addition to institutions, to make their own voices heard. Much has been written about the participatory nature of the web as it has gradually evolved since the 2000's. During this period, many innovative projects emerged from museums themselves – even before the term Web 2.0 was coined that enabled new kinds of participation and active contribution. The evolution, or better, the Web 2.0 revolution, brought with it the growth of blogs, wikis, and a host of social networking tools, and platforms that enable end users to not only read other's content, but to generate and publish their own micro-data.

Rather than simply describing a new set of standards or services, the social tools and the authoring interfaces that characterise Web 2.0 in fact signify a paradigm shift in the ways we use the Internet. The emerging model can now be understood as a multichannel model, where the web acts as a conduit, running through distributed networks that make connections not only between Virtual Museums and their users, but also from individual directly to individual; therefore bypassing the institutions themselves. This section provides a brief overview of the different kinds of Web 2.0 platforms in the context of our discussion on Virtual Museums, and will describe what it is about them that make them distinct from traditional Web 1.0 environments.

Through different kinds of Web 2.0 services, perhaps for the first time, everyone is able to publish their own content; upload their favourite images, share their preferred music and video collections – even open up an online diary – allowing others to sift, search and access our micro-content, while, at the same time we may access theirs. This opens up new opportunities for the folk (you and me) to forge new horizontal connections with like-minded colleagues, friends, fans and business partners. Once connected, we can make our voice heard in all sorts of creative ways. Through innovative collaborations, mashups, and remixes we are able to enter into a relationship with a museum, an institution that has mostly acted – until recently – from within the traditional broadcast model approach.

In contrast to the Web 1.0 broadcast model, Web 2.0 platforms locate the user – as prosumer – in the...
centre; blurring of the role of the producer and consumer who in turn produces, consumes, and mixes his own, and others’ micro-content. Peer-to-peer networking has evolved, (according to the Internet World Stats in December 2011 there are nearly 800 million Facebook users around the world) so that a large percent of online traffic moves across these sites, rather that stopping off in the deep silos of content that are located as collections on institutional sites. With all these people talking directly to each other, the reality is that museums are being bypassed unless they maintain their own presence on Facebook, YouTube, Twitter and all the other popular social networking platforms that allow them to take part in the day-to-day; often minute-by-minute chatter of the online conversation. When individuals create their own content – including the kinds of content once associated with the museum profession – this could be seen as a direct assault on memory institutions, which previously held the monopoly of specialised content as well as disseminating the knowledge that related to their collections. Now everyone can be a curator, in just the same way as we are all photographers, musicians, writers and authors – online at least.

Perhaps the most au courant of the Web 2.0 platforms is the blog. Blogs first appeared in 1997, becoming more visible from 2001 onwards, when free service management platforms became available to all – and for free. A blog is a hybrid between a diary and journalism on-line, characterised by chronological ordering of information: the blog phenomenon encompasses a horizontal network of bloggers known collectively as the blogosphere, recalling perhaps an electronic, and expediential iteration of Jürgen Habermas’s public sphere of the previous century. Once personalised with graphics and layouts in a template, your blog allows you to publish stories, information and opinions with total autonomy. Articles are linked to a theme (thread), in which readers can write their comments and leave messages for the author. Every article is numbered within the blog and can be specifically indicated through a permalink, pointing directly to a specific article. In some cases there can be a number of bloggers who write for the one blog.

Alternatively there are photo-blogs, driven by imagery rather than by text or video, which primarily disseminates video content; the kinds of formats that are often popular with Virtual Museums, as their content is often visually driven. Video dissemination has become associated with the enormously popular site YouTube. Three former PayPal employees created the video-sharing site in February 2005, which has now become the number one since its takeover by Google in 2006. Alexa ranks YouTube as the third most visited website on the Internet, behind Google and Facebook. As it is simple to both upload and access videos over YouTube, Virtual Museum’s often use the site to embed videos in their own homepages, websites or mobile platforms. In this case the envelope of the page is identified, as the Virtual Museum while the user is actually access the video directly from YouTube.

A wiki (from a term in the Hawaiian language that means “very fast”), is a website, linked as hypertext documents that is modified by its readers. The content of a wiki is developed in cooperation with all those who have been registered in the system and who identify themselves as they make their own contribution to individual Wiki pages. The modification of the contents is open and free, but it is chronologically recorded in order to enable changes to be reversed. The aim of a wiki is the sharing, exchanging, storing and optimizing of knowledge in an atmosphere of cooperation. The best known of the sites on the wiki platform is of course Wikipedia, the free, collaborative, multilingual Internet encyclopedia, supported by the non-profit Wikimedia Foundation. When museum content appears on Wikipedia this can be seen to
challenge the authority of the traditional museum as sole keeper; not only of the collections, but also of the knowledge woven around them. However, as new partnerships evolve; such as GLAM WikiProject (Galleries, Libraries, Archives & Museums) new kinds of shared production and dissemination have relinquished the monopoly of content was previously proprietary to the museum.

Other forms of user-generated content include those platforms that incorporate social tagging as a means to become pro-active. Users place "tags" freely into a Virtual Museum, a blog post, a photograph, a video, etc. thus facilitating new searches within the tagged content base. Classification using social tagging is no longer based on a hierarchical order of the content, as we would expect in a typical Virtual Museum, since the user can insert more than one key word. The more a tag is applied by a number of users, the more the term will increase in popularity and precision in categorization. Main search categories will therefore be created in the sites on the basis of the themes that are most frequently accessed and tagged by users. Categorization thus becomes “democratic”, not imposed from above but from below, and evolves spontaneously as more users tag the content.

The term folksonomy, coined by Thomas Vander Wal in 2003, derives from the words folk and taxonomy and has often been used in the context of the Virtual Museum as a form of distributed classification, potentially to be shared by the whole community of users. Tags; as folksonomies, are not a priori structured into the controlled vocabularies such as those that created by institutions, rather denote categories and sub-categories that the user according to his or her own associations. Making individual annotations to content bottom-up in this way means that user generated content (as tags) can shared by others. One of the disadvantages of this however is the proliferation of variants for a term (synonyms, homonyms, single/plural use, small case/upper case, etc.), which essentially creates a series of unusable tags – as a long tail. To avoid these misnomers, clustering techniques can be applied, where some elements are grouped together, so that different tags are treated as if they were one (e.g. Folksonomy, folksonomy or folksonomies). The folksonomy system is used when it isn’t possible, or desirable to centrally manage classification, and where the public is welcome to participate in the classification of the content. However, tags may be seen as highly personal, so much so that idiosyncratic expressions do not really help anyone else find content other than the original tagger.

According to Vander Wal, 2007 the value in this external tagging is derived from people using their own vocabulary and adding explicit meaning, which may come from inferred understanding of the information/object. People are not so much categorizing, as providing a means to connect items (placing hooks) to provide their meaning in their own understanding.

One of the first examples of tagging in a Virtual Museum was the Steve Project, a collaboration of museum professionals and others who argued (according to their website) that social tagging might provide profound new ways to describe and access cultural heritage collections, and encourage visitor engagement with collection objects. Their activities include researching social tagging and museum collections; developing open source software tools for tagging collections and managing tags; and engaging in discussion and outreach with members of the community who are interested in implementing social tagging for their own collections.
According to Wyman, B., et al., Tagging lets us temper our authored voice and create an additional means of access to art in the public’s voice. For museums, including these alternative perspectives signals an important shift to a greater awareness of our place in a diverse community, and the assertion of a goal to promote social engagement with our audiences (2006).  

In a discussion of the Virtual Museum in a Web 2.0 world is not complete without at least a brief reference to the popular social networking sites such as the Facebook, Twitter, Yahoo-owned Flickr, and the recently launched platform Pinterest.  

Launched in the spring of 2004, Facebook was first conceived as social networking directory for Harvard students. As social connections naturally extended beyond the Harvard campus, so their online network quickly grew. The idea behind the network was taken from the printed book of faces that is distributed across campuses. These in-campus publications were designed so that students could get to know one another by reading about other students, and to be able to recognise fellow them from their photos; something that was just as critical for lectures as it was for students. Today, even those without the previously indispensable .edu or .ac email account can sign up and maintain daily or even hourly contact with their own personal network. There are hundreds of mini applications available to embed over Facebook and with a single click you can add hundreds of different gizmos to your own Facebook page. Another way to take advantage of this highly popular network is to create a Facebook page for the entire museum. Perhaps in the same ways as in the 1990’s if you didn’t have an Internet presence you simply didn’t exist, so museums have created their own pages on Facebook with followers who ‘like’ the museum; keeping updated with the museum activities; exhibitions, events and exhibition openings appearing on their own Facebook page. Keeping up to date with everything in your life is presumably much easier if everything is centrally located in a single space as Facebook would like us to do, and other social networking platforms take advantage of this centrality by parsing their content; and even their login registration via Facebook.  

Twitter a micro-blogging interface that allows you to send “tweets” - text-based posts, up to 140 characters in length does exactly this. It not only keeps you in touch with your own network; whether you want to know who has been skiing this week, who has split up from whom, or who has just added the latest gizmo to their own Facebook page. Your tweets can be re-tweeted, aggregated through hash tags # and shared throughout the world across the horizontal network of other tweeters. Usage is easily analysed through a plethora of online metrics, allowing tweets to be tracked, measured, and visualised as trends as they travel through the network. It is now common for all public facing sites to integrate a Twitter feed into their home pages and, of course, Virtual Museums are no exception.  

The Yahoo-owned Flickr, has been integrated into Virtual Museums for many years in that it acts as a platform for users who may wish to contribute their own images and share them with others in the context of a shared theme without having to breach the walls of the Virtual Museum. In this way the public site can act as a catchall for new content that can dovetail into the Virtual Museum agenda in all sorts of innovative ways. The advantage of placing Virtual Museum video content on Flickr, like on YouTube, is the horizontal dissemination of content. Traffic may originally come from the Virtual Museum but at the same time traffic
will be streaming in from others who are already on social networks and will discover Virtual Museum content as they graze along the net.

The last social networking site we will discuss here is the recently launched (May 2010) image-sharing site Pinterest. According to their website - Pinterest is a Virtual Pinboard that lets you organize and share all the beautiful things you find on the web. People use pinboards to plan their weddings, decorate their homes, and organize their favourite recipes. The advantage for the Virtual Museum is the way images are organised. Photos are pinned in a series on a single pinboard; each with its own theme, much in the same ways a Virtual Museum would curate an exhibition. Pinboards are shared across the network and others can share both individual photos as well as entire boards. Currently you have to receive an invitation to sign up for Pinterest but it will be interesting to see whether the social networking platform becomes popular – or not.

Other platforms have shown great promise for Virtual Museum including the trendy Second Life virtual world that continues to exist even after you log out. In spite of the immense potential for the Virtual Museum, a world where visitors could ‘walk’ or ‘fly’ round exhibitions and visit entire historical simulations as miniature avatars from the comfort of their own chair, the platform seems to have passed its hype curve around 2009. The advantage of this kind of Virtual Museum meant that participants could visit the world in real time; build together, interact with one another, even purchase objects and clothing in-world creating a totally – yet tiny – immersive experience for all. All of us perhaps over the age of 18, as children were not permitted to sign in. This did not bode well for Virtual Museum, committed to its universal principle that granted access to all – including those under the age of 18.

There were many lessons learned for designers to explore a virtual world from Second Life. Using the in-world toolset and uploading images from your own directory it was easy to learn how build and develop content in Second Life. There were, and still are many opportunities for creative expression to re-create museum quality content with great fidelity, and with the addition of almost free access to the public- these mini-worlds; such as Second Life could be experienced by more than one person together – just as in the real world we visit a physical museum together with others. There is much potential from Virtual Museums to develop in the future over platforms of this nature and whether a social networking site like Pinterest becomes the next Facebook, or a new virtual world takes the place of the world developed by Linden Labs - only time will tell.

9.3 CURATING A VIRTUAL MUSEUM

This section aims to frame some basic principles to think about how to create and maintain a Virtual Museum. You are welcome to use the check-list as a means of visualising the different options you might encounter as you design, build, and maintain your own Virtual Museum. Feel free to check more than one option in each section.

- Step 1: Define your partners: content partners, production, and users
Who will be your potential partners?

Museum  
Library  
Archive  
School  
Higher education  
Funder

Who will be producing your Virtual Museum?

In-house  
Vendor  
Higher learning lab  
Community  
Crowd-sourced

Who do you see as your main user community?

General public  
Professional  
K-12  
Academic research  
Special interest group

· Step 2: What kind of experience are you developing?

Educational  
Entertainment  
Gaming  
Marketing

· Step 3: Who will be leading the production, and who will have the last say?

Funder  
Vendor  
Research group  
User
· Step 4: Will you be incorporating controlled vocabularies?
  
  Mono-lingual Thesaurus  -
  Multi-lingual Thesaurus  -
  Linked Open Data (LOD)  -
  Common standards  -
  Other  -

· Step 5: Usability testing
  
  Pre-production  -
  Post-production  -
  User group  -
  Heat maps  -
  Profiling  -
  Scenario testing  -

· Step 6: Planning for long-term preservation
  
  Future funding  -
  Interoperability  -
  Migration  -
  Conversion  -
  Other  -

· Step 7: Measure of success
  
  User satisfaction  -
  Donor satisfaction  -
  Large user base  -
  Reported in the press  -
  Request for future service  -
10. ANNEXES

REPORT ON TASK 3.2.1 META-DATA SCHEMAS AND MAPPING SYSTEM;
LEADING PARTNER: CIC

To achieve the goal of defining an ontology for Virtual Museums, Cineca coordinates work on task 3.2.1:

- aggregation of semantic schemas of metadata
- definition of a mapping system for various content metadata
to be implemented in the main technological platform of the project, according to the various metadata existing in the market and solutions proposed by the past and on-going EU funded initiatives, and in particular Cineca will advance the use of the ISO standard CIDOC-CRM.

Introduction

In order to reach the goals in task 3.2.1 the following requirements were identified:

- An ontology (metadata schema): it allows to describe objects of a virtual museum. In particular the use of CIDOC-CRM.
- A mapping procedure: the “to do” list for domain-expert which define a procedure to create a mapping from a source schema to a target schema
- Mapping template: a file in a standard language having a defined structure. Requires:
  - a mapping schema structure (DTD, XSD,..)
  - a mapping representation language (XML,…)
- Mapping editor tools: they allow to help domain-expert to edit the mapping template
- Deployment tool: it allows the translation from the source schema to the target schema through to the mapping template and processes it for the deployment finalized and the query of the metadata.
A translator can:
  - transform all data source in new format and query these new data
  - translation on the fly: the source data are preserved and are queried applying mapping file
- Library of mapping templates: collection of mapping templates for metadata schemas already having a mapping file to CIDOC-CRM

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Collection of semantic schemas of metadata
The digitization of cultural objects creates a series of museum collections that are stored in different places. Museum objects from different collections can be linked and presented in a virtual exhibition. In reality, this would not be possible because the objects are in different places and the bring together would be associated with high cost. The data collections of all museums can be combined and presented in a virtual “world museum”. To achieve this, the digitized cultural objects must be stored in a common format. A common exchange format ensures that the digitized objects can be archived and reused.[1]
Our scope is to identify a metadata element set to describe digitized cultural objects (and virtual museums). This is useful to digital preservation and ensure the quality of the digitized data.
Below we report the collection of different types of metadata. This metadata are about museum, archive, library, historic environment, general heritage and resource discovery. This list is not complete, these are the main semantic schemas of metadata used in cultural heritage.

SPECTRUM: is for the documentation and management of a museum collection. It should contain all those functions that are common to most of the museums. It contains the procedures for documenting objects and the processes that control them. It also identifies and describes the information that needs to be maintained.

CIMI: is committed to bringing museum information to a wide audience, encouraging an open standards-based approach to the management and delivery of digital museum information, focused on interoperability and usage of common tools in a museum context.

CDWA LITE: is a schema for encoding core records for works of art and material culture to describe objects of fine art, it includes both administrative and descriptive metadata.

Museumdat: is a generalization of CDWA Lite for the use of different collection types, (e.g. cultural
history. It takes into account the event-oriented multi-disciplinary approach of the CIDOC-CRM.

**EDM**: is an integration medium for collecting, connecting and enriching the descriptions provided by Europeana content providers.

**EAD**: is a standard for archival description (also used for collection description).

**CCO**: Cataloguing Cultural Objects is a data content standards for museum to describing cultural works and their images. It is designed for descriptive cataloging.

**VRA CORE**: is for the description of works of visual culture. It is used to transfer and exchange object data in the field of cultural heritage.

**CIDOC-CRM**: is a conceptual object-oriented model that provides the extensible ontology for concepts and information in cultural heritage and museum documentation.

**Dublin Core Metadata Element Set**: is a vocabulary of fifteen properties to be used in resource description. It is a vocabulary for describing resources of any kind on the www.

**AMICO**: each metadata can record detailed information about the type of object (artworks) that is being described in the AMICO data dictionary.

**LIDO**: is an explicit format for collecting museum data, used in many areas such as archaeological or cultural history museums.

**Element set for the Library of Congress Digital Repository Development**: Administrative metadata used for managing and preserving objects in a repository; structural metadata is used for storing objects in a repository and for presentation; descriptive metadata is used for discovery of objects.

**MIDAS** (monument inventory data standard): The UK data standard for information about the historic environment.

**Object ID**: standard for describing cultural objects. Developed through the collaboration of the museum community, police and customs agencies, the art trade, insurance industry, and dealers of art and antiques.

**Evaluation of CIDOC-CRM as the core standard**

Cultural heritage is a complex domain and it presents many possible associations and the definition of models of representation requires domain expert work. The major initiative in this area is the CIDOC-CRM. Since 2006 CIDOC-CRM is the international standard (ISO 21127:2006) for the controlled exchange of cultural heritage information (CIDOC-ICOM). It was created by the International Committee for Documentation of the International Council of Museums CIDOC/ICOM) and it was chosen in V-MUST project as the reference ontology for its capability to describe concept and relationships used in cultural heritage domain in a meaningful and detailed way. The CIDOC Conceptual Reference Model (CRM) provides definitions and a formal structure for describing the implicit and explicit concepts and relationships used in cultural heritage documentation. The core model is about 86 classes and 134 relationships.

Its objective is to cover all concepts relevant to cultural heritage and museum documentation and it is
extensible (due to diversity of museums subjects): adding concepts and relationships for the needs of more specialized communities (e.g. CRM-FRBR, CRM-DIG, CRM-EH)

CIDOC-CRM is a conceptual specification, so it can be implemented using a variety of knowledge representation languages (e.g. RDFS, OWL)

The CIDOC CRM is intended to promote a shared understanding of cultural heritage information and the CRM provides a common and extensible semantic model that can map any cultural heritage information. It’s major feature is that is event-centric: CIDOC-CRM approach is different from the more traditional cultural heritage documentation, which is usually object-centric.

Event-modelling of CIDOC-CRM contains:

- a part of the complex knowledge required for historical and cultural documentation and
- an event-centric point of view that can provide a view of the past or current life history of a cultural object (cultural-historical analysis).

In CIDOC CRM, the basic idea is that the historical and cultural contexts can be represented by things, people, and events/activities (space and time). The event-centric model allows also to represent aspects about cultural heritage documentation. We analyzed functional unit [12] of the event-centric model to evaluate the goodness of CIDOC-CRM. Some topics about cultural heritage extracted from the “Questions about Virtual Museum” document in the section “Variety of Cultural Heritage assets that can/should be represented in a Virtual Museum” were studied in order to see concepts/relations involved for the topics in a virtual museum. Also V-MUST glossary was also considered to complete the study:

- Modelling of time – Analyzed Space-Time and Time-Span information (space/time relationships)
- Historical events - Analyzed the Core Event Schema for this argument in CIDOC-CRM
- Artworks - Analyzed Cultural artworks or Cultural Heritage collection all relationships for collection of artworks and for single objects of a collection refers to any materials collected by museums
- Archaeological sites – Analyzed some examples of representation described in paper about archaeology. More specializations for archaeological domain are represented in CRM-EH.

A procedure to create a mapping template

It’s good practice have a “to do” list [10][11] to remember the main path to create a mapping schema:

- Detailed analysis of the source data schema (semantic of the schema)
- Eventual selection of relevant subset of the data structure with reference to the scope and goals of the case study
- Preliminary definition of the basic elements and concepts present in source data schema
- Identification of the events and processes that are implicitly or explicitly represented in the data schema
This activity is implemented by domain and IT expert. To help domain-expert in his activity is useful make available the functional unit created from authors of CIDOC-CRM [12]: basic graphic relationships to help domain-expert in mapping process.

**Mapping: mapping editor tools and deployment / conversion of source data**

The process of mapping includes these steps:
1. Define a mapping schema: create a correspondence between source schema to class of CIDOC-CRM
2. Use the mapping schema to physically extract information from the original data, Encoding/translating them in RDF (generally from XML or DB to RDF)

The result is archived in a RDF store that manage it. The creation of mapping templates from source schema to CIDOC-CRM can be done in several different ways.

The approaches vary a lot, including manual work and semi-automatic tools to assist the domain expert in the implementation of the mapping.

We report below a collection of Mapping Editor tools and Mapping Deployment/converter Tools to assist the domain expert and the IT expert in the creation of mapping template and in the deployment of source schema in the target schema to make available the querying of source data in the new schema.

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<table>
<thead>
<tr>
<th>Mapping tool</th>
<th>Editor Project</th>
<th>Description</th>
<th>Download</th>
<th>Online demo</th>
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| MINT Ingestion Server | National Technical University of Athens | Used in (some examples):
ATHENA (From a schema to CIDOC-CRM). See info about ATHENA in above record.
CARARE (From a schema to CIDOC-CRM and MIDAS Heritage) CARARE will ask its content providers to map their native metadata schema to an implementation of the CIDOC CRM which will in turn be mapped to the Europeana Data Model (EDM) | [https://github.com/min
t-ntua/Mint-Athena](https://github.com/mint-ntua/Mint-Athena) | [http://oreo.image.ece.n
tua.gr:8080/mint/Home](http://oreo.image.ece.ntua.gr:8080/mint/Home) |

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## LIDO (From a schema to LIDO)

- **URL:** [http://oreo.image.ece.ntua.gr:8080/edm](http://oreo.image.ece.ntua.gr:8080/edm)

## EDM (From a schema to EDM)

- **URL:** [http://oreo.image.ece.ntua.gr:8080/cidoc/Login_input.action](http://oreo.image.ece.ntua.gr:8080/cidoc/Login_input.action)

## AMA - Archive Mapper for Archaeology (AMA)

**Web Site:** [http://www.epoch-net.org/index.php?option=com_content&task=view&id=222&Itemid=338](http://www.epoch-net.org/index.php?option=com_content&task=view&id=222&Itemid=338)

**Project:** EPOCH EU Project

It is a semi-automatic tool for mapping existing datasets, including excavation databases, museum collections and free text data, to CIDOC-CRM.

- It allows users to import XML data models and to map them to the CIDOC-CMR schema.
- The result is the creation of a mapping file to be used as a template for the data conversion process.

**Web Site:** [http://ama.ilbello.com/](http://ama.ilbello.com/)

## Mapping tool (included in Finds Identifier Software)

**Web Site:** [http://www.brickscommunity.org/](http://www.brickscommunity.org/)

**Tool:** BRICKS (Building Resources for Integrated Cultural Knowledge Services)

Based on XSLT.

## CRM XML Mapping Utility

**Web Site:** [http://www.cidoc-crm.org/docs/mapping](http://www.cidoc-crm.org/docs/mapping)

- **Utility:** CICOD-CRM
- **Function:** It is used for a manual schema matching definition from any schema to CIDOC-CRM.
<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
<th>Document/Resource Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>XML2RDF Data Transformation Tool</td>
<td>Generic data transformation tool maps XML data files to RDF files, given a schema matching definition, based on its Mapping Language Schema (There is a XSD schema)</td>
<td><a href="http://www.cidoc-crm.org/downloads/MappingTool(XML2RDF-DataTransformation)(v%201.1).zip">http://www.cidoc-crm.org/downloads/MappingTool(XML2RDF-DataTransformation)(v%201.1).zip</a></td>
</tr>
<tr>
<td>D2RQ Platform</td>
<td>The D2RQ Platform consists of: D2RQ Mapping Language, a declarative mapping language for describing the relation between an ontology and a relational data model. D2RQ Engine, a plug-in for the Jena and Sesame Semantic Web toolkits, which uses the mappings to rewrite Jena and Sesame API calls to SQL queries against the database and passes query results up to the higher layers of the frameworks. D2R Server, an HTTP server that can be used to provide a Linked Data view, a HTML view for debugging and a SPARQL Protocol endpoint over the database.</td>
<td><a href="http://sourceforge.net/projects/d2rq-map/">http://sourceforge.net/projects/d2rq-map/</a></td>
</tr>
<tr>
<td>Stellar.consol/Stellar.web</td>
<td>STELLAR Best practice guidelines for mapping and extraction of archaeological datasets into RDF/XML representation conforming to the CIDOC CRM-EH standard ontology Enhanced mapping tool for non-specialist users to map and extract archaeological datasets into RDF/XML representation conforming to CIDOC CRM-EH Map and extract archaeological datasets into RDF/XML representation conforming to CIDOC CRM-EH (by non-specialist users)</td>
<td><a href="http://hypermedia.research.glam.ac.uk/resources/STELLAR-applications/">http://hypermedia.research.glam.ac.uk/resources/STELLAR-applications/</a> <a href="http://reswin1.isd.glam.ac.uk/stellar/STELLAR-Setup.msi">http://reswin1.isd.glam.ac.uk/stellar/STELLAR-Setup.msi</a></td>
</tr>
<tr>
<td><a href="http://www.cidoc-crm.org/crm_mappings.html">http://www.cidoc-crm.org/crm_mappings.html</a></td>
<td>It's possible to define detailed mappings from a source format, such as Dublin Core or FRBR, to the CIDOC-CRM. This definition can then be used to generate an XML file. This program requires Microsoft Access to be installed in order to run.</td>
<td>_tool_4_12_02.zip</td>
</tr>
<tr>
<td><a href="http://www.cidoc-crm.org/crm_mappings.html">http://www.cidoc-crm.org/crm_mappings.html</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LIBRARY OF MAPPING TEMPLATES: EXISTING MAPPING

Already mapping files to CIDOC-CRM can create a library of templates that is useful because they can be directly applied to the source data (databases) having a schema already present among the mapped ones.

Below a list of existing mapping templates:

- LIDO
- Dublin Core Metadata Element Set
- MIDAS
- SPECTRUM
- AMICO
- EAD

Collecting existing mapping templates present some problems of integration:

- mapping to different version of CIDOC-CRM requires the resolution of interoperability
- each mapping file can have a different mapping schema structure
- not all mapping files described in papers are full available

References

Metadata
[3] DIGITAL object metadata and list of metadata standard

Mapping definition

Mapping documentation

Mapping procedure
[18] Functional Unit
http://www.cidoc-crm.org/cidoc_graphical_representation_v_5_1/graphical_representation_5.0.1.html

About Virtual Museum

CIDOC-CRM
[22] Example about CIDOC-CRM http://www.cidoc-crm.org/docs/carpar_for_Prague.ppt

CIDOC-CRM Extension - CRM-Dig
[28] Martin Doerr, Maria Theodoridou Institute of Computer Science, FORTH-ICS, Crete, Greece

Existing mapping templates

CIDOC-CRM particular cases
[34] M. Doerr, A. Kritsotaki, Documenting Events in Metadata
[36] Paul Cripps, Anne Greenhalgh, Dave Fellows, Keith May, David Robinson, Ontological Modelling of the work of the Centre for Archaeology
[37] G. Hiebel, K. Hanke, I. Hayek Methodology for CIDOC CRM based data integration with spatial data
REPORT ON TASK 3.2.3. SEMANTIC DATA ENRICHMENT AND QUERY; LEADING PARTNER: CIC.

The following part of the document is organised as follows: in section 2 the tool for semantic enrichment of textual document is presented. Further to the text analysis tool, in Section 3, audio analysis tools are discussed. In particular a detailed discussion on the automatic speech recognition module has been presented. In Section 4 a brief discussion on the visual analysis tools is presented. The result of textual, audio and visual annotations will be integrated in the V-MUST platform.

2. Textual data: Concept Mapper

The purpose of “Concept Mapper” is to analyse textual documents and speech transcripts, extracting the most relevant concepts and attaching semantic metadata to the documents [1] [2]. “Concept Mapper”, developed by CINECA during the FP7 project Papyrus, provides a list of keywords, extracted from text, along with information that explains the meaning of each keyword, as used in the document. For each keyword, a relevance score for the document and relevance score for the domain of interest are also reported. All this information is extracted from the text using Wikipedia based analysis. First a shallow parser is used to detect keyword candidates, then Wikipedia content is used to disambiguate the keywords and to evaluate their relevance.

The concept extractor “Concept Mapper” uses Wikipedia as linguistic resource, to extract the most descriptive concepts in a text. Useful information from Wikipedia is also attached to the extracted concepts.

The main goal of this component is to enhance the search engine indexing.
In order to achieve this result, for each detected concept, the component provides the following information:

- The strings that were identified as representative of the concept and their frequency in the textual item
- Information about the Wikipedia page that describes the concept:
  - Title
  - Translations in other languages
  - Anchors text and redirects
  - Categories
  - The first paragraph (that is a short description of the concept)
- A score of relevance for the textual item (internal relatedness)
- A score of relevance for the domain (external relatedness)

Given a Wikipedia page, an anchor is a string that is used in Wikipedia as the text of a link to that page. The relation among the anchors of the same page is very close to synonymity. Redirects are special pages without text that have just a title and are used in Wikipedia for query expansion: they encode pluralism, technical terms, common misspellings, and other variants. This information, along with translations, can be used to help the search engine to retrieve documents using strings that are not present in the original document, but that identify concepts that are used in the text. The concept definition may also be used for this purpose. Internal and external relatedness can be used to select only those keywords that are relevant for the textual item or the domain.

The concept extractor is implemented in four steps:

1) Candidate keywords extraction (noun phrases are selected using a shallow parsing procedure)
2) Candidate keywords disambiguation (whenever a noun phrases could refer to more than one Wikipedia page, the one that best relates to the textual item is chosen. The internal relatedness is estimated in the internal process of this step)
3) Keyword ranking and selection (internal and external relatedness are used to choose which of these topics
This application works with reasonable qualitative performance on both textual items and ASR transcripts. It must be noticed that some of the concepts detected are named entities. This makes this application a viable alternative also for NER, especially when dealing with ASR transcripts: in this case most unlikely named entities can be pruned by the selection process. Obviously, in order to be recognized by this method, a named entity must have its own Wikipedia page. Most famous peoples, organizations, companies and locations meet this requirement.

3. Audio based content structuring

The main objective of this module is to analyse the audio component of video items. It provides the video content structure by identifying segments with homogenous audio characteristics/features and by supplying a descriptive label for the content (such as speech, male, speaker A, noise, etc). It finally performs automatic speech recognition (ASR) on those segments that have been identified as speech segments, thus providing a transcript of the spoken words.

The functionality of this module includes extracting the audio track from the video item and classifying the audio stream into different features. The module integrates speaker diarisation (speaker segmentation of the input signal followed by speaker clustering of the created segments into homogeneous groups), speech/non-speech classification, and gender classification. The results of speaker diarisation are used as input for ASR.

This section describes methods and tools developed and integrated in the Audio module for multimedia items content structuring. It is focused on Speaker Diarisation and Speech Recognition as it gives insight on video items structure by identifying segments with homogeneous audio characteristics/features and by providing a descriptive label of their content (e.g. “speech”, “male”, “speaker A”, “noise” …) and Automatic Speech Recognition (ASR) that is the process of converting speech (acoustic waveform) to human readable transcriptions (text strings).
same time), all within the same file or input stream. By structuring the audio stream into speaker turns, Speaker Diarisation results can be used for the indexation of multimedia documents making possible, for example, to track people across recordings.

With the increasing number of broadcasts, meeting recordings and voice mail collected every year, Speaker Diarisation has received much attention in recent times by the speech community, as is manifested by the specific evaluations devoted to it under the auspices of the National Institute of Standards and Technology (NIST) for telephone speech, broadcast news and meetings.

A typical Speaker Diarisation system conceptually performs these tasks:

1. Audio Feature extraction: features extracted from the audio stream are intended to suggest information about the speakers in order to enable the system to separate them optimally.
2. Speech activity detection: an audio stream may consist of some acoustic activities like speech, noise, music, background conversation and silence. Nonspeech regions should be detected and removed from the audio stream.
3. Speaker change detection: inside every speech region, a speaker change (or speaker turn) detector is used to find points in the audio stream which are candidates for speaker change points.
4. Gender detection: it allows, for the segments classified as speech, to detect if the speaker is a male, a female or a child.
5. Speaker clustering: segmented regions, belonging to the same speaker, are grouped together. This does not entail whether such segments come from the same acoustic file or different ones.

Different algorithms applied in different order, mixed together and repeated iteratively can perform these tasks. A framework for Speaker Diarisation and Speech Recognition was set up for the V-MUST project, based on already available open-source software. The resulting framework is a collection of commands, libraries and scripts. Instead of developing a single application (or library) capable to handle all the problems together, it was decided to keep the task distinct and to glue together the code through scripts.

The ASR solution is based on Sphinx3, an open source ASR software from Carnegie Mellon University. It works for English and French using public domain Acoustic and Language models. Other languages can be added if acoustic models will appear in open source project like Voxforge.
To visualize the result of segmentation and transcription tool like Elan can be used.
A script to transform the result of audio analysis in a suitable format will be provided.
4. Video content structuring

The objective of this component is to index videos. To achieve this, the component integrates different modules for video processing in order to extract the embedded semantics from the video: shot boundary detection for categorising shots with similar attributes and key frame extraction, which extracts visually significant frames from each shot boundary.

The most valuable meta information available for multimedia streams is their temporal structure, like shots or scenes. The detection of edits is fundamental to any kind of video analysis and video applications since it enables segmentation of a video into its basic components: the shots. The number of possible edits is quite large. In general, all edits can be classified into the following three categories:

- Hard cuts
- Fades
- Dissolves

Shot boundary detection is one of the common techniques for content structuring.

This section presents a representative selection of the leading approaches in this area. As it is a fundamental problem, much of the early research on video analysis concentrated on this task. As “hard” cuts (i.e. when the video moves from one shot to another in successive frames) is the most common shot boundary type, many techniques focus specifically on detecting this type of shot cut. Boreczky et al. [4] identify the main techniques in shot boundary detection as pixel difference, statistical difference, histogram comparison, edge difference, compression difference and motion vector based. Each of these techniques were implemented, and extensively tested on a dataset consisting of general television programs, news, movies and commercials. In general, it was found that the simpler algorithms (specifically colour histogram based algorithms) performed best. Browne et al. [5] also implemented three different shot boundary detection methods: a colour histogram based approach, an edge histogram based approach, and an approach using the motion information encoded in the macroblocks of MPEG-1 data. The three approaches were tested on thirteen different videos, ranging from news to cookery programs. Overall, it was found that a colour histogram approach outperformed the edge detection and macroblock based approaches.

The solution chosen for V-MUST is the Intermedia Annotation Tool Chain developed by RWTH in the FP6 project INTERMEDIA-NoE [6]. In specific the “scenecuts” tool will be adopted. This tool detects scene cuts (shots) in arbitrary video material and the keyframe for each shot.

In “scenecuts”, shot boundaries (or scene cuts) are detected based on color histograms in HSV color space. By averaging over a couple of frames, small jumps in histogram entries are smoothed and only non-transient changes result in a jump in histogram differences that indicate a shot boundary. Also, a long-term comparison with the start of the current shot allows detecting gradual changes resulting from transition effects like wipes or dissolves. The tool is invoked via command line and given the path to the video to be analyzed and an output path where a simple MPEG-7 like description of its temporal structure is stored. To visualize the result of segmentation open source tool like Elan can be used. A script to transform the result of video analysis in a suitable format will be provided.

The keyframes can be saved using ffmpeg as image file (png, jpg..) with different resolutions and then used in other programs, for example for retrieval based on context (CBIR like Lire or Fire) or to train image classifiers using for example the “classifier” tool available in the intermedia Annotation tool. The tool can be used to either learn a scene type from a number of still images or compare a list of images to a one or more trained scene types like news cast anchor persons, the weather forecast or TV show trailers. When used to classify images, the result is a simple text file containing one line per input image that just lists the names of all detected scene types.
An example of video segmentation:
http://www.youtube.com/watch?v=JmEnvhTtHsM

Appia Archaeological Park Virtual Narrative Museum
The video has been segmented in 46 scenes.
For each scene a keyframe is identified (below the snapshots of the first 9 keyframes)
References

REPORT ON TASK 3.2.4: VIRTUAL MUSEUMS THESAURUS AGGREGATION AND IMPLEMENTATION, LEADING PARTNER: CDR

What is a Thesaurus
1. A thesaurus is a reference work that lists words grouped together according to similarity of meaning (containing synonyms and sometimes antonyms), in contrast to a dictionary, which contains definitions and pronunciations. Although including synonyms, a thesaurus should not be taken as a complete list of all the synonyms for a particular word. The entries are also designed for drawing distinctions between similar words and assisting in choosing exactly the right word. Unlike a dictionary, a thesaurus entry does not give the definition of words. (Wikipedia definition)

2. A thesaurus is a structured and defined list of terms that standardizes words used for indexing (the Australian Pictorial Thesaurus).

3. A thesaurus is the vocabulary of a controlled indexing language formally organized so that the a priori relationships between concepts are made explicit. Like a wordlist, a thesaurus is a tool based on a standardized terminology, which helps the user to select occurrences in a database following a certain logic. http://thesaurus.european-heritage.net:

Introduction
Within the field of research and the formulation of a theoretical apparatus applied to the Virtual Museums, the presence of a thesaurus of reference has a crucial importance. The online presence of thesauri, some of which are extremely structured, (e.g. ‘Historical Thesaurus of the OED), drives us to combine, and to finalize the work already done within the EU for the purposes of the goals of the project, rather than create a new thesaurus for V-MUST.Net. The work done in WP2 (D.2.1 - http://V-MUST-dev.cineca.it/) has already indicated preliminary categories for the classification of Virtual Museums. The extension of this work, through an analysis of existing online thesauri, will lead to the creation of a new thesaurus linked to a glossary, whose features are outlined below.

Why use a thesaurus?
Classifying records according to function brings many benefits for the management and effective retrieval of records. The use of a thesaurus or other controlled language tool can assist organisations to produce quality metadata. Thesaurus terms are generally used to title records. These terms will therefore populate the ‘title’ metadata field. Function elements also form part of the metadata standard and the thesaurus can assist with populating these fields.

Some rules for compilation of a thesaurus
This section explains key concepts and relationships in thesaurus construction. They are based on the international standard ISO 2788– 1986 Documentation – Guidelines for the Establishment and Development of Monolingual Thesauri.

Key terms used in these guidelines are defined as follows:

**Thesaurus:** a controlled list of terms linked together by hierarchical, associative or equivalence relationships.

**Keyword thesaurus:** a records management thesaurus based on functions and following the principles of keyword classification.

**Keyword classification:** involves grouping records into broad, functionally based areas represented by keywords.
Records are further classified by the use of activity descriptors and optional subject descriptors.

**Classification**: systematic identification and arrangement of activities and/or records into categories according to logically structured conventions, methods, and procedural rules represented in a classification system.

**Hierarchical relationships**

A hierarchy is formed when a preferred term represents a concept which can be linked to another term with a broader or narrower meaning. Broader term indicates that there is a term with a wider meaning than the term given. Conversely, narrower term indicates that there is a more specific concept than the one listed. In a keyword thesaurus for records management, the broadest terms represent functions of an organisation. They are referred to as keywords. Activities that are carried out as part of that function are presented as narrower terms of the keyword. They are called activity descriptors. Subject descriptors are further refinements of the activity descriptors, presenting aspects or topics of the activity.

**Equivalence relationships**

The use of preferred and non-preferred terms is a characteristic of a controlled language thesaurus. Preferred terms are permitted terms that can be used to represent a given concept. Non-preferred terms, also known as ‘forbidden’ terms, are not used to classify documents and records. They are included in the thesaurus to act as pointers to preferred terms (ISO 2788 3.6). This relationship between preferred and non-preferred terms is the equivalence relationship. When two or more terms can be used to refer to a given concept, one is selected as the preferred term to be used in the classification scheme (ISO 2788 8.2.1). Non-preferred terms are included in the thesaurus, as access points for users.

**Associative relationships**

Association is used when preferred terms at the same level of the hierarchy are related in meaning and it would be useful to draw users’ attentions to a similar term that may more accurately represent the concept they wish to describe. Associative relationships are indicated by the ‘related term’.

**Additional information about thesauri:**

What controlled vocabularies, taxonomies, thesauri, ontologies, and metamodels all have in common are: They are approaches to help structure, classify, model, and or represent the concepts and relationships pertaining to some subject matter of interest to some community. They are intended to enable a community to come to agreement and to commit to use the same terms in the same way. There is a set of terms that some community agrees to use to refer to these concepts and relationships. The meaning of the terms is specified in some way and to some degree. They are fuzzy, ill-defined notions used in many different ways by different individuals and communities. Thesaurus (1) Can be reflected as one word to many or (2) Can be more expanded and have classified terms set in a hierarchical manner. Searches may be performed by choosing from a list or by typing a free text (Boolean). This list includes post-coordinated terms. An example of a classified thesaurus is Getty’s Art and Architecture Thesaurus.

**Survey of online thesauri**

<table>
<thead>
<tr>
<th>Project/Institution</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object Name Thesaurus</td>
<td></td>
</tr>
<tr>
<td>Oxford English Dictionary</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>British Museum Thesaurus</th>
<th><a href="http://www.collectionslink.org.uk/assets/thesaurus_bmon/Objintro.htm">http://www.collectionslink.org.uk/assets/thesaurus_bmon/Objintro.htm</a></th>
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<tbody>
<tr>
<td>The Getty Research Institute</td>
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</tr>
<tr>
<td>Official web portal of the Italian Culture</td>
<td><a href="http://www.culturaitalia.it/pico/thesaurus/4.1/thesaurus_4.1.0.skos.xml">http://www.culturaitalia.it/pico/thesaurus/4.1/thesaurus_4.1.0.skos.xml</a></td>
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<td>European Heritage Network</td>
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<td>Internal Cultural Centre</td>
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<td>West Virginia University</td>
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</tr>
</tbody>
</table>

**Definition of an ontology for Virtual Museums**

| Grant Agreement 270404 | Cyprus Institute | Public | 70/82 |
For the drafting of a thesaurus for V-MUST.Net surely the best example among the many other tested is the thesaurus of the British Museum, for its structure agility, usability and completeness. To start from the work already done in WP2 is certainly a good starting point to achieve the aim of this task, adding the relevant terms from Virtual Museums. In order to create an ontology for Virtual Museums, in our opinion, the drafting of a thesaurus is not enough. It’s also important to provide a glossary that gives definitions to the same terms. The glossary can also be used in the website of the project, whose presence is expected, but especially in the project platform that is part of the main activities of WP3.

As an example we can refer to the glossary of the Museum of Imperial Fora (http://www.mercatiditraiano.it/servizi_scientifici/glossario) for art and archaeological terms. Museum Galileo (http://catalogue.museogalileo.it/index/IndepthIndex.html) is a good example for the terms more closely related to the Virtual Museums. In order to continue the research and the preparation of a thesaurus and a glossary for V-MUST.Net we also propose below a survey of glossaries dedicated to the websites of the museums.

Survey of online glossary

| Museo Galileo - Virtual Museum | http://catalogue.museogalileo.it/index/IndepthIndex.html |
| Webref | http://www.webref.org/archaeology/archaeology.htm |
| Archaeology UK | http://www.digital-documents.co.uk/archi/glos_rom.htm |
| About.Com Archaeology Dictionary | http://archaeology.about.com/od/glossary/Archaeology_Dictionary_Index.htm |
| Great Archaeology | http://www.greatarchaeology.com/glossary.php |
| Archaeological Institute of America | http://www.archaeological.org/education/glossary |
| West Virginia Division of Culture and History | http://www.wvculture.org/shpo/glossary.html |
| Turkey Archaeological Glossary | http://www.toptenturkey.com/Glossary.htm |
| British Columbia | http://www.for.gov.bc.ca/archaeology/glossary.htm |
| M3 GLOSSARY OF ARCHAEOLOGICAL TERM | http://www.m3motorway.ie/Archaeology/GlossaryofArchaeologicalTerms/ |
| Oracle education foundation | http://library.thinkquest.org/3011/glossary.htm |
| New archaeology | http://www.newarchaeology.com/articles/gloss.php |
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For the documentation for the mapping

Mapping language

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[3] Example about CIDOC-CRM:
[6] Martin Doerr, Athina Kritsotaki,

Available: http://www.cidoc-crm.org/docs/cidoc_crm_version_5.0.2.pdf

CIDOC-CRM Extension

MAPPING PROCEDURE
[12] Functional Unit
Existing MAPPING TEMPLATES
http://www.cidoc-crm.org/crm_mappings.html Section Particular Mapping Definitions

METADATA
DIGITAL object metadata and list of metadata standard
UVA, together with CDR, IME, NL and CREF-Cyl, will compile a list of existing technologies involving Virtual Museums, as indicated by the initial reports in WP2 and present that state of the art in technological installations available today and assess their usefulness and applicability in the Virtual Museum domain.

Installation and Context: The State of the Art in Presentation Technology

The following list of existing technologies used for the installation and presentation of Virtual Museums has been developed using the deliverables from the V-MUST.net work package 2, which covers Virtual Museum requirements and criteria analysis. The content presented in WP2, specifically in deliverables 2.1 (Terminology, Definitions and Types of Virtual Museums) and Deliverable 2.3 (State of the Art on Virtual Museums in Europe and Outside Europe), indicated the current state of the art in the technological installations available today and provided the basis for the development of this list of installation presentation technologies included below.

To bring greater focus to this list of the state of the art in installation presentation technologies, we will examine the format of Virtual Museum applications, including online, onsite, mobile, and offsite formats. Since the aim of this sub-task concerns installation and context, special attention will go to those which are onsite, interactive, and immersive installations. By focusing on onsite installations, we are able to closely study the usefulness and applicability of the technologies used for the Virtual Museum applications within the physical, contextual space of a museum. Since online applications are quickly being developed for more and more museums and cultural heritage institutions, there will be a short section following the list of onsite presentation technologies which will go over some of the technologies being utilized by online, offline and mobile application developers. The list of online, offline and mobile presentation technologies will be less extensive compared to the list of onsite presentation technologies because of the comparably limited presentation forms available for accessing online, offline or mobile application content.

The state of the art technologies have been identified with a “+” symbol, and with each state of the art presentation installation media listed, there is a brief assessment on usability and applicability within the domain of Virtual Museums. The assessments have been made by considering the ways the technology both affects and is affected by the target audience (including users and visitors of all forms), by the content being presented, and by the changing context of the content.

Virtual Museum Presentation Technologies

Onsite/In Museum

Onsite Installation: This non-distributed format of Virtual Museum applications refers to those whose software or hardware components are not publicly available, whatever the reason (technical need or political choice) of such lack of availability, and only place in a particular site some way connected to their content.

Non-distributed Virtual Museum: A format of Virtual Museums, including all Virtual Museums conceived to be not distributed but only run in specific installations, according to institutional decisions. Non-distributed Virtual Museums include onsite installations and portable Virtual Museums.

Display Screen: A display screen (television or computer monitor) used to present video or image content for users. Display screens have evolved from bulky rear-projection monitors of limited sizes, to thin and flat LCD screens of varying sizes and dimensions. Display screens are different from projection screens, in that they do not require a separate video or image projector to function.

Video Projection: The projection of video or images using a digital or video image projector onto a projection...
screen or space. More recently, video projection has become available in 3D with the use of stereoscopic projectors, accompanied by the use of 3D glasses (see below Stereoscopy).

+ **Gesture-based Interaction System**: A system based on physical gestures using the hands or the head where the interface is not attached to the body (e.g. with a webcam or XBox Kinect) or a system based on an interface with a (handheld) device (e.g. with a Wiimote).

  **Usability Assessment**: In addition to the equipment necessary to present the Virtual Museum application, gesture-based interaction systems also require unique software and hardware, such as the Xbox Kinect or the Wii Wiimote. Users of such systems likely require some instruction before initial use, especially where complex movements are required to interact with the Virtual Museum. Physically impaired may not be capable of fully interacting with the system (likewise with seniors and young children). Limitations of the software or availability of devices may also restrict user experience.

+ **Speech-based Interaction**: This refers to a system whose functions are based on speech recognition, either basic voice-command input ("Start simulation!") or more advanced natural language input ("Show me something interesting from ancient Rome!").

  **Usability Assessment**: Speech-based interaction systems are challenging to implement because of the range of vocal tones and accents of the varying users. One must also pronounce words very clearly and carefully in order to interact with the Virtual Museum. While simple commands, such as “go” or “stop” are easier to follow, advanced natural language input may be less reliable and requires extensive programming. As with gesture-based interaction systems, users of such systems will require some instruction on the vocabulary or grammar used by the system before initial use.

+ **Multimodal Interaction**: This new form of interaction provides the user with multiple modes of interfacing with a system by means of several distinct tools for input and output of data. These tools may include elements from gesture-based interaction and/or natural interaction systems.

  **Usability Assessment**: By providing multiple forms of interfacing, different kinds of users can access the content in the manner best suited to their learning needs. Users have to learn how to interact with the different modes of interfacing. Cost of hardware and software to accommodate multimodal interaction systems may be high (depending on number of modes of interaction and complexity of the programming required).

+ **Multi-user Interaction**: This new form of interaction aims to provide multiple users with the opportunity to interact with a single interfacing system, using gesture- or device-based interaction. Once example where this form of interaction can already be experienced is the Polyapton multi-touch system at the Archaeological Museum of Thessaloniki (http://makedonopixels.org/index.php?c=3&sub_c=6&I=e#).

  **Usability Assessment**: Potential to let multiple users access information at their own pace and depth. Too many users could overwhelm the system or other users who seek a personalized interactive experience (e.g. individual audio guidance not possible as there would be too much overlap). The cost of such a system largely depends on the hardware and software used to accommodate the multi-user interaction, as well as the modes of interaction and the complexity of the programming required.

+ **CAVE (Cave Automatic Virtual Environment)-like Systems**: These are high immersion systems that produce a virtual reality environment where projectors are directed at 3-6 walls of a small, cube-like room. Immersion can be heightened through the addition of audio or a natural interaction system.

  **Usability Assessment**: While this system can offer a high immersion experience for a user, the system requires a great deal of space and equipment to function. Although the cost of projection equipment has decreased, this system still requires multiple projectors to function as a CAVE. Additionally, the cost of software development and the inclusion of any interaction system can significantly increase the cost of implementation. In a museum context, it may be difficult to
integrate such a system into the exhibition space, as it requires a considerable amount of physical space and equipment to operate. This system is most successful when used with content that presents a virtual reality environment, such as archaeological reconstructions or sites.

**ImmersaDesk**: Similar to CAVE-like systems, the ImmersaDesk creates a low immersion environment using stereoscopic projection (with 3D glasses) and natural interaction (using sonic head and hand tracking).

**Usability Assessment**: The smaller screen makes this system more practical than the larger CAVE-like systems - fewer projectors are required, less space is required, and it may be more affordable. The small screen is wide enough for single user to have an immersive experience, but it is not intended for multiple users at a single time. Fortunately, the ImmersaDesk is compatible with the existing CAVE-like systems, including the libraries, interfaces, and software. Alternatively, the same experience may be achieved with an active-stereo projector and a natural interaction system, such as an XBox Kinect.

**Stereoscopy**: This refers to the technique for creating or enhancing the illusion of depth in an image by presenting two offset images separately to the left and right eye of the viewer (e.g. 3D projectors).

**Usability Assessment**: This has traditionally required the user to wear 3D glasses, but technology is evolving so that the glasses may soon not be required for some of the 3D television sets. For now, 3D glasses are still commonly required to experience stereoscopic content. 3D glasses are often delicate and can break easily, but can also be subject to theft. The use of 3D glasses are a disadvantage to those who already wear glasses; the 3D effect still works with ‘a pair of glasses on another pair of glasses,’ but it is not very comfortable or convenient. Another drawback of this kind of technology is that it can create dizziness or nausea, eye-strain can occur after having been immersed in a stereoscopic environment for too long, and those who suffer from stereoblindness will only see two separate projections. New projectors and camera models are also being equipped with the option to select 3D, allowing a user to shift easily from 2D to 3D (for both content presentation or capture).

**Personal 3D Viewer or Head Mounted Display (HMD)**: This refers to a VR headset, which provides the individual user with a personal immersive experience created by a stereoscopic headset and accompanying audio (e.g. Sony Personal 3D Viewer).

**Usability Assessment**: Allows a single user to experience an immersive environment alone (no shared immersive experience, unless avatars are used). There is high cost due to very recent commercial availability, and use of this equipment is demonstrated best through high quality VR environments. A user also needs a small amount of physical space to be able to walk around in order to change the scenery. Depending on the model used, a HMD may require a user to wear a small pack containing a computer and battery (requires physically capable user).

**Digital Signage**: More than just a display screen, digital signage is developing to incorporate touch interaction and is being designed for commercial use, which means the screens will be more robust and longer lasting.

**Usability Assessment**: Digital signage is an attractive and interactive way for the user to explore Virtual Museum content. Such digital signage is designed to last 5+ years, but this would depend
on usage. Larger screens are more expensive but smaller screens may have lower impact.

+ **Mixed Reality (MR):** Closely related to VR, MR combines AR (augmented reality) with AV (augmented virtuality).

  *Usability Assessment:* Requires the use of a mobile (smartphone), hand-held device (e.g. iPad or tablet) or movable screen system, and content development to combine AR with AV. Mobile or hand-held devices can create a separation between the user and the environment (user may be more concerned with MR content on mobile or hand-held, rather than the physical content in their immediate surroundings). There may also be a strong division between high user expectation and the actual quality of the visual experience. Depending on the availability of the MR content, a user may need to rely on availability of WiFi connection and/or a webcam to access the content and/or for the MR content function properly.

**Online**

**Online Virtual Museum:** An online Virtual Museum is a museum designed in the nominal worlds of a computer and existing in the internet, giving the visitor the illusion of being present in an actual museum.

**Remote Visualization:** This refers to the interactive viewing of scientific data sets over the web (e.g. online catalogue or archive).

  *Usability Assessment:* Since scientific data sets are in the gigabyte size range, it is difficult to send the entire data set over the network. Extraction, processing, networks latency and rendering add up to make the proposition of near real-time interactive visualization a challenge. Moreover, the user will have a limited amount of memory and CPU power for viewing and interacting with the data.

+ **Social Networking Site:** Social networking sites are an online tool that can be used to access networks of individuals (social structures), e.g. Facebook, Twitter, Hyves.

  *Usability Assessment:* Such sites can be used to greater insight into user profiles and preferences, however privacy remains a concern for users. Used to inform wide audience of users about upcoming events or projects. Free, (or low subscription cost) means of advertising or crowdsourcing. High volumes of users of Facebook, for example, have brought Facebook.com to become the second most popular websites in the world (http://www.internetworldstats.com/facebook.htm).

**Mobile**

**Remote Visualization:** This refers to the interactive viewing of scientific data sets over the web (e.g. online catalogue or archive), using a mobile device, such as a smartphone.

  *Usability Assessment:* Since scientific data sets are in the gigabyte size range, it is difficult to send the entire data set over the network to a mobile device. Extraction, processing, networks latency and rendering add up to make the proposition of near real-time interactive visualization a challenge. Moreover, the user’s mobile device will have a limited amount of memory and CPU power for viewing and interacting with the data.
**Mobile Applications for Virtual Museum:** These are Virtual Museum applications which have been made available for mobile devices (iPhones, SmartPhones, tablets, etc.) in relation to such a specific release, independently of distribution and copyright terms.

**Usability Assessment:** A benefit of mobile Virtual Museum applications it that they can be used both onsite and offsite, but may rely on WIFI availability. Offsite use of a mobile Virtual Museum can serve to inform the user before an onsite visit. Onsite use can provide greater depth of information to a visitor, however this can also separate the user from their environment. Users access the applications on their own mobile devices. Mobile applications can be offered for free or for a low price. Battery life may be an issue for hardware, depending on the duration of use and the projected battery use.

**Mixed Reality (MR):** Closely related to VR, MR combines AR (augmented reality) with AV (augmented virtuality).

**Usability Assessment:** Requires the use of a mobile (smartphone), hand-held device (e.g. iPad or tablet), and content development to combine AR with AV. Mobile devices can create a separation between the user and the environment (user may be more concerned with MR content on mobile, rather than the physical content in their immediate surroundings). There may also be a strong division between high user expectation and the actual quality of the visual experience. Depending on the availability of the MR content, a user may need to rely on availability of WIFI connection and/or a webcam to access the content and/or for the MR content function properly. Best suited for indoor virtual archaeology, embedded virtual reconstructions and onsite data exploration.

**Offsite**

**Distributed Offline Virtual Museum:** This includes all products distributed in any way and using any technology (e.g. CD, DVD, BlueRay or other offline supported formats), independently from terms and copyright conditions.

**Remote Visualization:** This refers to the interactive viewing of scientific data sets over the web (e.g. online catalogue or archive).

**Usability Assessment:** Since scientific data sets are in the gigabyte size range, it is difficult to send the entire data set over the network. Extraction, processing, networks latency and rendering add up to make the proposition of near real-time interactive visualization a challenge. Moreover, the user will have a limited amount of memory and CPU power for viewing and interacting with the data.

**Portable Virtual Museum:** Portable Virtual Museum refers to all the Virtual Museum applications whose software or hardware components are not publicly available, whatever the reason (technical need or political choice), but which can be potentially fruited in any place at the same conditions, without a binding link between the application’s physical placements and its contents.
**Mobile Applications for Virtual Museum**: These are Virtual Museum applications which have been made available for mobile devices (iPhones, SmartPhones, tablets, etc.) in relation to such a specific release, independently of distribution and copyright terms.

**Usability Assessment**: A benefit of mobile Virtual Museum applications is that they can be used both onsite and offsite, but may rely on WIFI availability. Offsite use of a mobile Virtual Museum can serve to inform the user before an onsite visit. Onsite use can provide greater depth of information to a visitor, however this can also separate the user from their environment. Users access the applications on their own mobile devices. Mobile applications can be offered for free or for a low price. Battery life may be an issue for hardware, depending on the duration of use and the projected battery use.
Alvin Toffler coined the term “prosumer” in his 1980 book, *The Third Wave*, to describe exactly this blurring of the role of the producer and consumer, the newly evolving role, which no longer falls into distinct categories in Web 2.0 platforms.

For example, fragile objects are best stored away from excess lighting rather than being permanently exposed to gallery conditions. This could cause a conflict of institutional obligations.


Individuals ascribed with the national designation of 'living treasure' include Lee Saeng-kang, National Living Treasure (Intangible Cultural Asset No. 45), who plays the daegeum, a large transverse bamboo flute, and dancer Yi Mae Bang (Intangible Cultural Asset No. 97).


See also the UNESCO discussion on culture - IV.2.2 Protecting cultural diversity through the preservation of cultural heritage in all its forms and through normative action, <http://portal.unesco.org/culture/en/ev.php-URL_ID=12619&URL_DO=DO_TOPIC&URL_SECTION=201.html> (Accessed 12.01.12).

Citing new media as one of the causes of a dumbing down of the museum was discussed at the ‘Beyond the Museum’ Colloquium in the Oxford Union Debating Chamber, April 2001 where the museum was positioned in a ‘popular versus elitist’ dichotomy. Debates issued from the launch of the 2001 publication the *Museums for the People*? the introduction of new media activities were cited as a contributing factor that caused a depletion of museum vitality. In the UK, the introduction of new media into the museum was cited as clinging ‘to the appeal of mass entertainment’ (Appleton 2001: 21) and gearing the encounter towards a closed outcome by the interactive technology which had been pre-programmed by the museum.


The Holodeck is a fantasy environment that functions like an immersive, holographic virtual reality system in the television series *Star Trek*. <http://www.startrek.com>, (accessed 12.01.12).

See the discussion on AR for museums on page 18 of the 2011 Horizon Report, Museum Edition.


The Reciprocal Research Network was co-developed by three First Nations communities, the Musqueam Indian Band, the Stó:lō Nation/Tribal Council, and the U’mista Cultural Society, <http://www.rrnpilot.org/>.

Taxonomies and thesauri are written into the Metadata, generally defined as data about data. Thesauri take taxonomies and extend them to make them better and to describe the world also by allowing other statements to be made about the subjects’. Introduction to Metadata, Getty Research Institute <http://www.getty.edu>.


26 CAVE - CAVE Automatic Virtual Environment, a room-sized advanced visualization tool that combines high-resolution, stereoscopic projection and 3-D computer graphics to create the illusion of complete sense of presence in a virtual environment. The CAVE was the first virtual reality technology in the world to allow multiple users to immerse themselves fully in the same virtual environment at the same time. CAVE is a registered trademark of the University of Illinois Board of Trustees.


28 Even Aristotle started his analysis with the consideration that the narrative concept in its broader sense involves all non-verbal practices (Aristotle, *Poetics*).

29 The Oxford American Dictionary defines mindset as ‘the established set of attitudes held by someone.’


34 [http://www.getty.edu/research/tools/vocabularies/index.html](http://www.getty.edu/research/tools/vocabularies/index.html)


36 Linked Data is about using the Web to connect related data that wasn’t previously linked, or using the Web to lower the barriers to linking data currently linked using other methods. More specifically, Wikipedia defines Linked Data as "a term used to describe a recommended best practice for exposing, sharing, and connecting pieces of data, information, and knowledge on the Semantic Web using URIs and RDF." [http://linkeddata.org](http://linkeddata.org)


40 [http://vanderwal.net/foolsonomy.html](http://vanderwal.net/foolsonomy.html)

41 [http://www.steve.museum](http://www.steve.museum)


43 [http://www.facebook.com](http://www.facebook.com)

44 [http://www.twitter.com](http://www.twitter.com)

45 [http://pinterest.com](http://pinterest.com)

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