

Virtual Manuscripts for an Enhanced Museum and Web Experience ‘Living Manuscripts’

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Abstract. Due to preservation and conservation issues, manuscripts are normally kept in research libraries far from public gaze. On rare occasions, visitors can see these priceless objects, typically separated from them by a sealed case, with only a fixed double page spread visible from a manuscript that may contain hundreds of folios. This restricts the amount of knowledge offered by these books. This paper proposes the creation of virtual manuscripts as exhibits in their own right in a museum context, and as part of a web-based virtual learning environment offering visitors the unique opportunity of engaging with the manuscripts, providing further possibilities for accessing the heritage and cultural information contained in them. A database supplying information about and from the manuscripts, held in a virtual environment, creates the illusion of their “real” presence and materiality. ‘Living Manuscripts’ aims to stimulate and encourage engagement with vulnerable materials via an innovative virtual experience.

1 Introduction

Ancient manuscripts are great treasures and an important part of our heritage; full of narratives, they give us access to the wealth, culture and imaginative capital of the past. Researchers in several branches of the Arts and Humanities study them as texts, images or both; more recently scholarship of this kind has begun to engage with e-Science (collaborative and interdisciplinary approaches using new technologies), whilst the agenda of conservators and curators is to protect and preserve their holdings in order to give to everyone today, but also tomorrow, the possibility of continuing if restricted access to these treasures. Due to conservation issues, on the rare occasions when these manuscripts are exposed to public view, they are typically displayed under glass in sealed cabinets, and opened to show just one fixed double-page spread. It is sometimes possible to find an explanatory label on the side or front of the showcase, indicating the name of the author as well as the approximate year of creation of the manuscript and details (if known) of its provenance. Unless a specialist, the visitor will not have access to the multi-layered knowledge that these

manuscripts team with. Catalogues go some way towards resolving this issue, but tend to be limited in scope and potential appeal.

This project proposes to make use of virtual reality (VR) technology to bring these manuscripts from long distant centuries to life. Electronic exhibits installed inside a museum will allow visitors to engage interactively with these valuable artefacts in a more complete manner. Amongst requirements for the project, a key objective is the creation of an innovative, powerful, and large scale viewer to show the manuscripts from any angle. The book itself will be recreated in three dimensions, its “pages” being derived from high-resolution photographic files (TIF files) of the real folios, specially prepared as part of a Leverhulme Research Fellowship [1] (Ainsworth, University of Sheffield) by a team comprising scholar, digital photography consultant and curator. Visitors thus have the opportunity of viewing the entire (digitised) manuscript while enjoying an immersive experience and navigate inside the environment. For example, users can turn the pages in an intuitive way and zoom in and out, as well as read a translation into modern English of the text of the current page. Visitors can also navigate from the environment to underlying material stored in ad hoc created databases accessed from a grid-enabled portlet. This enhances their potential appreciation of the content, stories, and historical background to the manuscripts. A novel navigation system of virtual hot spots placed on the relevant part of the pages has been specially created. Furthermore the virtual manuscripts will offer a personalised experience of the book by providing different information, whether the visitor is an average visitor, a child, a researcher, a non-native speaker or has a disability. A key objective of the project is to amaze and delight museum’s visitors and web users, to give them the impression that they are dealing with something radically different from anything they have experienced before – as a prelude to a more pleasurable and personally engaging learning process.

2 Virtual Environments for Entertainment

Technology is often used in museum exhibitions, where touch-screens or simple computers offer a multimedia exhibition experience. Can virtual reality technology offer a more involving experience with the artefacts than currently used multimedia? Joseph Bates describes virtual reality as a “new medium, new entertainment, a new and very powerful type of art.” [2] (p.1). Virtual Reality is the next step beyond books, television and cinema; as a visualisation technology that can be applied for medicine, science, architecture, and elsewhere such as heritage, education, literature, museums, galleries and art. The manuscripts featuring in this exhibition are resources for historians, with the stories they tell; for pupils and teachers, for their knowledge of the past; and even for artists and art historians, on account of their remarkable and beautiful illuminations. Bates (1992) still considered that there was a lack of presentation resources for virtual worlds, explaining that: “in film, the feeling of the underlying world is greatly influenced by the lighting, camera angles, focus, editing” [2] (p.5). Today, computing technologies allow the integration of all these components within virtual environments. VR is therefore certainly a suitable tool for displaying such manuscript material. Bates (1992) also notes that one is accustomed to having normal control over their bodies and

perceptions, finding the lack of control confusing and perhaps unpleasant. Consequently care must be taken to ensure that the interaction with the virtual exhibit occurs as naturally, agreeably and spontaneously as possible. Moreover, the environment needs to be rich enough to give the user the possibility of interacting with as many elements as possible. “This must be done in such a way as to leave the user with an undiminished feeling of free-will”; [2] (p.6) calling for the application of Human-Computer Interaction (HCI) principles.

3 Virtual Museums as Enhancement of Real Museums’ Experiences

A museum is defined by the International Council of Museums (ICOM) as: “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. (...)” [3]. Some studies have been made taking into consideration this issue. Yonk-Moo Kwon (2003) [4] states that the essential functions of all kinds of museums, including virtual museums, are ‘exhibition, communication, research, acquirement, and conservation’ [4] (p.1). The solution proposed certainly fulfils the main “exhibition” function. To decide whether or not the project embodies a fully communicative aspect, an adequate definition is needed for communication in such a context. Communication is commonly defined as ‘the activity of conveying information’ [5]. The project’s virtual manuscript allows people to read and have ready access to the information contained in the folios and the linked database communicating with the visitors. From the standpoint of research value, the fact of being able to read a manuscript from a remote site provides worldwide researchers with the possibility of studying the manuscript book, and maybe even annotating it or responding via a collaborative environment. Moreover, at least one dimension of the conservation issue is addressed by the project as described above, since the virtual manuscript can neither age nor deteriorate. For the “acquirement” function, the virtual artefacts program as conceived also allows for display of any suitably digitized manuscript. In sum, the project as defined has a very good fit with the conceptual framework for a virtual museum exhibit. The exhibit uses the possibilities offered by new technologies to display a so-called virtual heritage. Although it will not compete with the real museum, it complements them. Each, moreover, retains its own appeal. In his project, Y.-M. Kwon [4] considers that a ‘virtual museum consists of roughly two parts, a museum server and interface orbit. A museum server conveys the museum services based on databases. Interface orbit is a conceptual term to represent user’s applicability according to devices’ [4] (p.2). The project described in the present paper somehow resembles Kwon’s solution as it will have all the resources open to the visitors stored in databases containing the digitised manuscript(s), translations, links to specific URLs or documentary films and video clips. In addition a range of interfaces will expand throughout the project. Y.-M. Kwon’s project is equipped with both Mixed and Virtual Reality technology; available on the museum’s site. An immersive experience is proposed where visitors

can navigate virtually inside Namsan – a Korean mountain granted World Heritage status by UNESCO – through an immersive theatre or a CAVE [6]. The solution proposed will provide a solution viewable in environments with different level of immersion from a CAVE to a hand-held device.

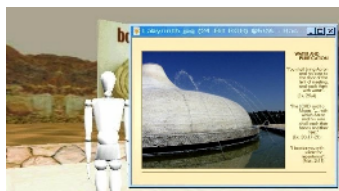


Fig. 1. SEE's screenshot of a board [7]

4 Learning and Entertaining in 3D Worlds

By bringing a virtual exhibit inside the museum, the project aims to introduce people safely and engagingly to extremely valuable manuscripts, and furthermore to offer them the possibility of learning while enjoying this immersive experience. Studies have already been conducted into the potential for associating entertainment and education in virtual environments. A particularly interesting exemplar is “The Shrine Educational Experience (SEE): Edutainment In 3D Virtual Worlds” [7] (Figure 1). In this project, Di Blas, Paolini and Hazan [7] state that, by re-using the experience of the Virtual Leonardo Project [8], they use the ‘3D graphic environment (...) as a “container” to display “objects” of the museum’. Similarly the solution proposed can be seen as having every single digitised folio as an object in its own right and the book as a its container. Di Blas et al [7], who focussed an important part of their work on the possibilities offered by real-time, were using the software CUSee-Me to broadcast the exhibition all day from the gallery; transforming local visitors in “spontaneous players on the live stage” (p.1). It is also hoped that our solution will be broadcasted in real-time to other mirror exhibition sites. Di Blas et al. (2003) also did a lot of collaborative work in the environment, allowing people to visit simultaneously and together the environment. For the SEE they used what they described as an “indispensable” virtual “museum guide” taking the view that users might easily feel lost in the virtual environment. The manuscripts project presents the virtual manuscript book without an accompanying guide. The interest of the visitor for the artefact is sustained by the entertaining and engaging nature of the exhibit; ensuring that the visitors see the entire potential of the virtual manuscript. One of the objectives is to let people learn as well as interact with each other and also play in the environment. Di Blas et al. (2003) tested the concept, of making students engage with the cultural content while enjoying themselves at the same time, with high school and junior high school pupils. At the beginning, the students received an introduction to the environment from the virtual guide; next, they received some cultural information; after that, they played two cultural and educational games, and finally received feedback on their experience. The result was that the game encouraged the students to move inside the environment and to move progressively throughout all the artefacts. On the other hand,

Di Blas, Paolini and Hazan [7] conclude that ‘3D worlds are clearly not appropriate architectures for disseminating large amount of information, as neither lectures nor expansive documents work well with new means of communication’ [7] (p.7). Personalised delivery of knowledge might be the solution to this problem delivering the right information to the right audience, since clearly the complexity and quantity of information underlying a manuscript might not be deliverable all at once or to all audience. 3D worlds also support discovery and experiential learning and navigation, and therefore are well suited for personalised delivery of knowledge.

5 Existing Viewers

Some manuscripts viewers are already available on the Web or on CDs. A very famous one is the “Turning the pages” collection and software produced by the British Library [9]. The software is available on a CD containing one complete, digitized manuscript per product. It allows one to view each page of the manuscript and to turn the page in view, or to go to the next or preceding page. The book is typically displayed on two open pages. The British Library recreated a book as a “host” environment for the product. However, the book is realised in two-dimensions and even if the execution is impressive, the limitations of using 2-dimensional representation are readily apparent. A sensation of depth (depending on the number of pages left on either side of those displayed) is not afforded; nor is it possible to determine how many pages are left, or when the last page has been reached, save for a line which says that the end of the manuscript has been reached. The British library team also equipped their viewer with a zooming tool. When this is activated, the image is decomposed into four parts. At the top left the page displays a section in zoom format, while at the bottom right a miniature image of the book is shown, with a rectangle representing the position of the part in zoom in the whole page. They also provide some explanatory material about the content of the page in view at the top right, plus some descriptive information about the part shown in zoom format at the bottom left. The British Library TTP collection offers an interesting interpretation of the viewing tool. Unfortunately, the possibilities offered are quite limited. The user cannot go directly to a page, has to navigate through each and every page; and must use the mouse to turn each page. Moreover, if the user has a pad rather than a mouse, the operation can be strenuous. Another drawback is that the zoom is fixed; the user is therefore unable to zoom in more or less at his convenience on a particular detail. The zooming feature also has a predetermined magnification that cannot be changed by the user. Another remarkable viewer available online belongs to the “Library of The Jewish Theological Seminary” project [10]. They have some manuscripts available online, accessible to any visitor from their website. The interaction is exceptionally pleasant to use. At the beginning, the visitor chooses a book from a shelf (*Figure 2*). The book is opened in a new window. It is then possible either to turn the pages one by one using the mouse or clicking on a button; furthermore, the visitor can also choose to go directly to a page, selecting it by its number. For each page turned, an animation is displayed giving the impression of a real page turning.



Fig. 2. Screenshot of Louis Marshall's bookcase **Fig. 3.** Floating Zoom 4X [11]
Fig. 2 and 3. Courtesy of The Library of The Jewish Theological Seminary [10]

In this viewer, the number of the pages currently in view is visible at the bottom of pages, compared to the total number of pages contained within the manuscript. This allows the visitor to know how many pages still remain to be seen and also when the end of the book has been reached. This software is also equipped with a zoom feature. Its display mode is that of a floating magnifying glass (*Figure 3*); the user is free to move in the page, moreover to magnify at 4x or 2x. For the 'living manuscripts' project, the aim is to deliver a product allowing greater flexibility from the user's point of view. The user will be in a position to check any particular detail, or to go straight to a particular folio. Users will have the impression of dealing with the real manuscript, and not only with the electronic folios. The technology employed for the two previously described viewers makes use of Macromedia Flash Player. In our case, the development environment uses an Oriented-Object language and a three-dimensional API. The final result will therefore necessary be different in concept and realisation at least from the use of 3-dimensions.

6 Existing On-Site Exhibits

The project will imply the virtual device to be brought into a public museum. Some museums already possess some state-of-the-art technology devices. Amongst the existing one, some are particularly interesting as on the archaeological site at Ename (Belgium). The town of Ename has an open-air museum of archaeological remains [12]. These have regrettably been badly preserved and are not intelligible to non-professionals visitors. In order to give visitors an overview of what the site used to be like; a virtual device, called TimeFrame (TimeScope for the prototype) was developed, allowing people to see the buildings that used to be there, shown together with virtual representations of their original inhabitants (*Figure 4*). Technically, 'TimeScope 1 consists of a video camera, a computer system, two monitors, and a touch screen. A specially designed on-site kiosk houses the system and protects visitors from the elements. The video camera is directed toward a particular section of the archaeological remains and it transmits real-time video images of those remains to the monitor screens in the kiosk' [11] (*Figure 5*).

Visitors can interact with TimeScope using a touch screen, and navigate successively through the different stages of the reconstruction of the building and its



Fig. 4. Animated Sequence of TimeScope1©[13] **Fig. 5.** Kiosk and projection ©[12]

structures. Users also have access to some multimedia material, some photos, maps and virtual animations; all describing the evolution of the site and its buildings'. Another advantage of TimeFrame is acts as a multi-user exhibit, allowing the visitors to go inside a wooden cabin and experience the display as a group. A survey asking visitors for their impressions has shown that everybody has been really pleased to discover these remains in a comprehensible way. They also have been enthusiast using these new interactive technologies. In the similar way, 'living manuscript' will provide visitors with virtual access to treasures on parchments. It is interesting to notice that the Ename project deploys a multi-user exhibit, whilst only one person at a time can actually interact with the touch screen. 'Living manuscripts' proposes to adopt a similar approach, all the more since the interaction is made using one big displaying device inputting haptics.

7 The Proposed Solution

First, the virtual manuscripts will be created in three-dimensional form, to host the digitised pages. Second, the pages are inserted inside their "container" (*Figure 6*). This operation is done automatically by the program in order to permit scrutiny of any manuscript accessible and selectable for viewing. A text file describing the content of each of the digitised manuscripts to be displayed is created and used by the program to generate the equivalent 3D version. Then a mechanism to move inside the environment and to see the book from further away from their vantage-point or from closer at hand is implemented. Animations are then realised. The first of the latter is a facility for opening or closing the book. The second addresses the action of turning the pages. This stage is more complicated than it seems: due to memory limitations, it will not be possible for all of the pages to be displayed simultaneously. Furthermore, one has to be sure that the proper, consequent page is in view, in the right sequence. The sensation of visual depth and volume is given by the thickness of the book depending on how many pages have already been turned. The next features to be implemented are the navigation tools. Some hotspots are created for location at the top of the virtual manuscript on the relevant part of the book's folios or a tool will be created in order to leave curators and specialists the freedom to place hotspots at positions they consider important. A floating bookmark is produced allowing the hotspots to appear and disappear. This function is essential so as to avoid detracting from the manuscripts' intrinsic visual and aesthetic presentational value.



Fig. 6. Screenshot of the opened book © Bibliothèque d'Étude et de Conservation, Besançon, France; MS 865 f. 1r [14] **Fig. 7.** Screenshot of 'Living Manuscripts' © Stonyhurst College Library, UK; MS 1, f 1r [15]

The hotspots give users the possibility of navigating inside the environment and to go to underlying material such as translations, videos or related pictures supplied from given databases. The implementation can be hosted in an immersive environment such as the RAVE using visualisation technology and navigation tools available in our laboratory or a portable 3D projectors version for the museum exhibition. The user's position is known using the sensors embedded in the 3D Glasses. The movements of the user will be tracked in order to enable movement inside the scene. The main idea is to let the visitor interact with the book in a manner that is as natural as can be contrived. Similarly the virtual artefact will be viewable within a web page and the navigation will take place with standard mouse and keyboard. Different scenarios will be implemented depending on the user. Subtitles in the native language of the visitor might be used (though the number of potential languages is an inhibiting factor), and proposals are afoot for interactive, digital-DVD-video games and competitions for children, together with more specialised underlying material for researchers or students, enhancement of volume and soundscapes for hearing-impaired persons, plus navigational aids for visually-impaired visitors.

One of the aims of 'living manuscripts' is to create a virtual environment to host the digitised image files for each page of the manuscripts. The manuscript has been recreated in 3-Dimensional format and hosts the pages inside it, as in a real codex. The pages are created as bendable polygons to create the illusion of naturally "falling" onto the board when the user turns them. Once the book and the pages are created, the digitized corresponding images are applied as textures. For memory reasons, all of the created pages of the book cannot be displayed at the same time. In practice, all the pages do not in fact "exist"; only a few do at any given time. As the pages are turned, a different texture is applied to the current page in view. In order to choose which texture is in view, a .txt file containing the name of all the book's pages is perused. Now that the environment is almost created in full, the book requires animation to be applied. This is to provide the basis for interaction between user and book. The book is constructed hierarchically in order to perform the animation calling a minimum of functions and so to reduce the time needed by the system to realize the operation. One important function is the one turning the pages. As a matter of fact, the user has to be able to turn the pages of the book (*Figure 7*) in a natural way, and to turn the exact number of pages in the book.

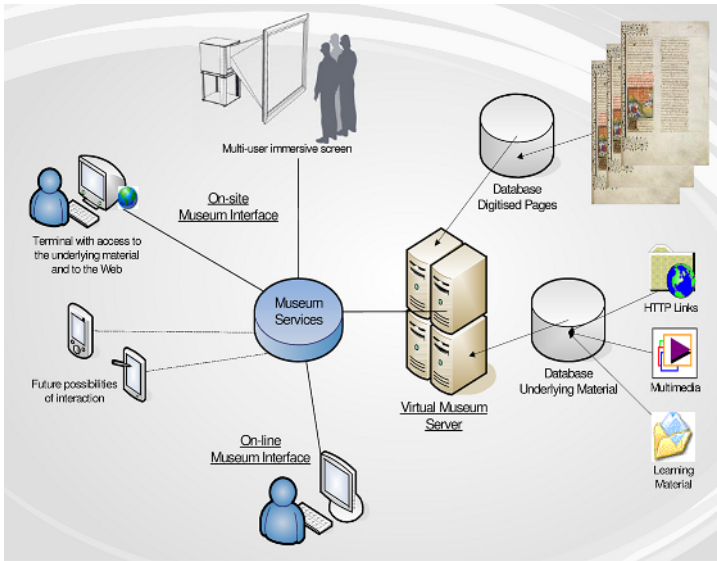


Table 1. Architecture of Living Manuscripts

The architecture for ‘living manuscripts’ is represented as Diagram 1. The museum will be at the centre of the project. The amount of interaction available will rely on the services offered by each museum. The information displayed will be stored in databases accessible via a virtual museum server. For each manuscript displayed, a corresponding database containing the digitized images of the pages will be accessible from the server. The underlying material will vary depending on how much information is available for a particular manuscript or exhibition. Concerning the user interface, part of the virtual museum will be available on-site during the exhibition either using an immersive screen, a terminal or possibly a hand-held device; whereas the other part will be available online using a personal computer.

8 Evaluation and Testing

To test the sustainability of the ‘living manuscripts’ project, we will first organize an evaluation on the prototype displayed both using PCs for the online version and a RAVE for the on-site version. In a second time, we have a 6-month national exhibition planned for the second semester 2007; where we will collect data on how the museum visitors and the web visitors use the different tools, how they interact with the virtual manuscripts, what they learn from this experience and what is their global satisfaction. These results will be used as feedback on the virtual museum and allow improving the tools. The 2007 exhibition has the ambition to be broadcasted in different museums at the same time.

9 Conclusion

A solution has been proposed for the preservation and appreciation of ancient artefacts belonging to our heritage, such as medieval manuscripts. As the paper has sought to demonstrate, 'Living manuscripts' aims to bring vellum manuscripts to life using virtual reality technology. The 'living manuscripts' are 3D interactive photo-realistic representation of the original manuscripts; they also provide additional manner to explore the content and the layers of knowledge that are related to the real artefacts. The virtual manuscripts can be deliverable to a wide audience as exhibits in a museum or on the web. The solution proposed will be tested within a planned simultaneous exhibition in several museums and on the web, to measure the impact of virtual learning environments such as the living manuscripts.

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