A 3D virtual library model: representing verbal and multimedia content in three dimensional space

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Abstract: In our paper we present a three dimensional model of a virtual library based on the presentation and navigation possibilities of the Virtual Collaboration Arena (VirCA) system. In the implementation of the virtual library model we selected Greek literary works from among others which were once available in the ancient Library of Alexandria. Using our developed system at present we can represent selected (ancient) texts and texts related to certain ancient authors and their life-work, image files attached to various texts in a given arrangement, in the three dimensional space of the VirCA system. We have implemented the virtual library model with a PHP/MySQL-based development providing a HTML/JavaScript-based search interface and XML-based search results which can be represented in the VirCA system.

Keywords: Library of Alexandria, spatial hypertext, VirCA system, three dimensional virtual library model

1. Why did we choose the Library of Alexandria?

The Library of Alexandria is definitely the most prominent and celebrated collection of classical (Greek-Roman) antiquity, but nothing was left from it — it is known only from the contemporary writers' works. Its fame has survived in the later ages too, but it has been embodied a library ideal till now representing a symbolic force. To give an appropriate answer to the above mentioned question we can say that it was an important aspect for us that all the Greek written materials brought together in this library were eternal values for human culture and erudition. We also took into account that the study of the poetical Greek works had remained an open issue till nowadays. Therefore we decided to focus on the field of ancient Greek poetry and drama once available in the Library of Alexandria. In our research we intended to present these ancient masterpieces in new formats and environment. In this sense it was crucial for us to attach various verbal and multimedia metadata to the English translations of the chosen ancient Greek texts in the three dimensional environment.

The Musaeum or Mouseion ("Institution of the Muses") at Alexandria was a research establishment built by Ptolemy I Soter and by his son, Ptolemy II Philadelphus at the turn of 4th and 3rd centuries BC. At that time, being as one of the successor states, Egypt belonged to the extended empire of Alexander III of Macedon, whose name is commonly known as Alexander the Great. A subsidiary "daughter library" was founded about 235 BC by Ptolemy III (Euergetes) in the Temple of Serapis. Later it had an important role in the history of the library.

The Library of Alexandria formed one of the most significant parts of the Mouseion funded by the royal treasury. Its mission was to gather all the Greek documents, so its ambition was to achieve completeness in written Greek literature. Soon it has amassed several thousands of papyrus rolls in its holdings. The library's editorial program contained the establishment of the Alexandrian canon of Greek poets. The museum and library continued to exist for many centuries, but were destroyed in the civil war that happened under the Roman emperor Aurelian in 272 AD; the daughter library was damaged badly by the Christians in AD 391. In 2002 the Egyptian government inaugurated a new library named the Bibliotheca Alexandrina, which was built exactly on the site of the previous ancient institution (Heather, 2010), (Grüll, 1996), (Novelli, 2010, p. 164.).

2. The structure of the classification scheme

Callimachus was the third director of the library between 260 and 240 BC. Under his leadership the library catalogue was created, resulted in the so called Pinakes (tablets). Its name originates from the appropriate parts of the catalogue on papyrus leaves which were stuck (probably written) on wooden tablets. Those tablets were placed above chests (or shelves) to facilitate a search for papyrus rolls and to make their reshelf more flexible. The full title of the catalogue was the following: *Tables of Those Who Have Distinguished Themselves in Every Form of Culture and of What They Wrote*. In Greek the „literature" word refers to education or erudition, so Callimachus, being adjusted to the Egyptian ruler's objective, intended to cover the complete Hellenistic culture in the index list of rolls. Using the author's approach Callimachus added a short biography to each author's name and he described the originality of each document. Since the title was seldom clear (if it existed at all), therefore he always added the first line of the work to his catalogue and noted how many lines the given work included (Heather, 2010).

The catalogue was composed of 120 books (rolls), and it had registered approximately 200 000 papyrus rolls. Since the library of the Mouseion was practically complete as regards Greek literary works, the catalogue is thought to be a national bibliography of contemporary Greek literature too. It also appears as ancestor of bibliography and science history because of its biographical notes (Macleod, 2005).

The structure reflecting the contemporary scientists' and literary men's intellectual system was separated into two levels:

- At the higher level there was a categorization of the writers that gave a 'skeleton' of the division.
- At the other level each category was given in alphabetic order by author.

Callimachus divided the library documents into two main parts: poets and prosaists. In both categories he created six sub-groups separately:

- poets: epic poets, elegists, satirical poets, lyrical poets, tragedians, comic playwrights;
- prosaists: historians, speakers, philosophers, physicians, natural scientists, miscellanies (here cookery books also emerged with a „dining writers" sub-title) (El-abbadi, 1990), (Wiegand, 1994).

3. Content in the library model

First we decided to implement Callimachus' hierarchical structure in our virtual library model. We selected three illustrious Greek ancient authors who would stand for each sub-group within the „poets" main category. We followed the same author's approach as Callimachus used in his catalogue by connecting the author's image or his bust with the author' name, and added a short biography to him. Using this approach we followed the same content layout that the Pinakes (i.e. name of Callimachus' catalogue) had in ancient times.

The long process of integrating various content into this library model included the following steps:

1. We tried to find images closely related to the authors' life and poetical works. These images covered a wide spectrum of artistic works: statues, graphics, marble reliefs, paintings and maps.
2. Then we gathered and edited a short biography of the chosen authors. Referring to their significance in Greek literature, we provided a short overview about their life and listed the most important masterpieces they created. Entries in Encyclopaedia Britannica and in Wikipedia online sources[1] were used and checked for this task.
3. Considering the copyright restrictions, we retrieved proper English translations of Greek poetical works. For this aim we could make use of the electronic version of literary works which were available in various digitization projects e.g. Perseus Digital Library Project (Tufts University), Project Gutenberg, Google Books Library Project, California Digital Library (University of California). Among them we emphasize the importance of Perseus Digital Library Project which has built a retrievable database from the old Greek texts both in native language and in English. Then we edited these English translations in one page (A/4) length and in the suitable format.

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[1] http://www.britannica.com/EBchecked/topic/14417/Library-of-Alexandria (et passim); http://en.wikipedia.org/wiki/Library_of_Alexandria (et passim) (2015-03-18)

4. All of the collected library content is required to be loaded into the VirCA system in a certain logical order and means according to the special characteristics of the software.

5. Searching for and displaying records in a virtual library

Nowadays, the overwhelming majority of the integrated library systems present their content in a form of bibliographic records. For example, searching for the keyword 'hypertext' in the 'Title' field of the records in the online public access catalogue (OPAC) of the University and National Library of the University of Debrecen (DEENK) (http://webpac.lib.unideb.hu/), the results will be available in a form of a list containing the author(s), title and publication year ("Date") of the items we have found (Fig 1):
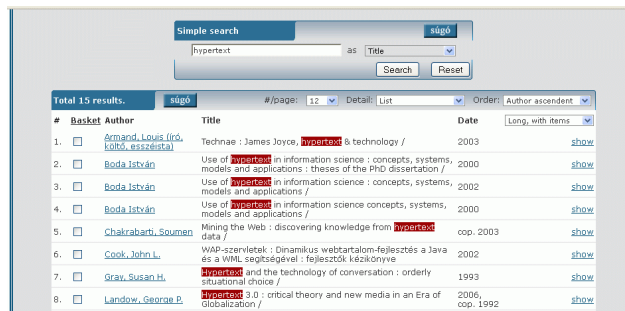

Fig. 1. Search results as displayed in the OPAC of the DEENK

Now we can see the detailed bibliographic description of any item by clicking on the 'show' link displayed on the right side of each line showing the main bibliographic data of the corresponding item. For example, selecting the book 'Use of hypertext in information science: concepts, systems, models and applications' by *István Boda*, the result will be as follows (Fig. 2):

Fig 2. Detailed bibliographic description of a book in the catalogue of the DEENK

Our basic idea is that in case of the implemented model of the ancient Library of Alexandria the relevant library records can be displayed in a form of 3D objects presented in a three-dimensional virtual space. For example, searching for 'Epic poets', 'Elegists' and 'Lyrical poets' in the catalogue of the virtual library, the results can be displayed as follows (Fig. 3):
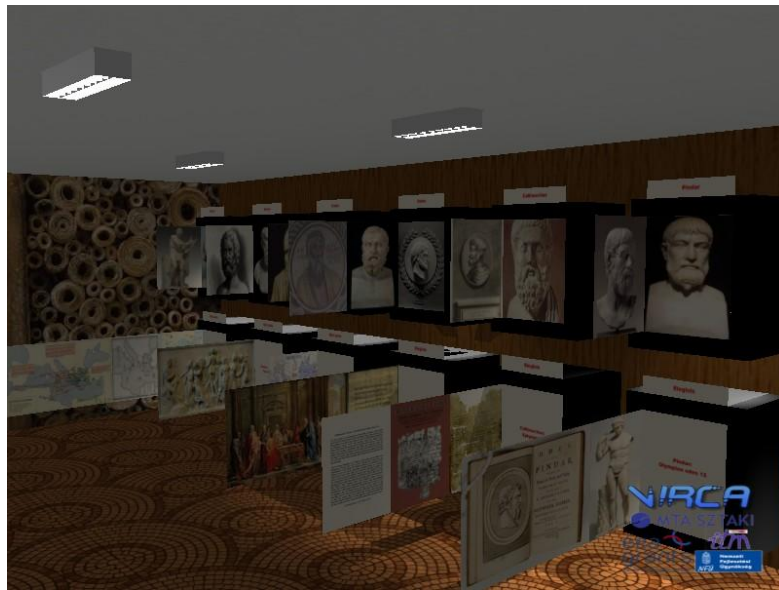
Fig. 3. Search results from the virtual Library of Alexandria I.

In the current implementation of our three-dimensional virtual library model, a maximum of 18 records can be displayed at the same time (i.e. the search results are limited to 18 records). In Fig. 3 we present a view from the top right corner of the virtual room where the objects are displayed. Here we can see 12 records (from the 18 records provided by the search) represented as objects in the 3D space.

Selecting a record in the 3D environment is very straightforward: we can simply go to the corresponding object and see its content by casting a glance at (or scrutinizing, if we like) the interior of the object which is represented as a kind of *cabinet* 'veiled' by a curtain – which can, of course, be 'lifted' to see the text (or image) of the record placed and illuminated inside the cabinet. Further implementation of the model includes the feature of displaying an (interactive) internet browser window in a cabinet. This new feature makes possible that the selected ancient Greek authors' CVs are directly downloaded e.g. from the corresponding Wikipedia entries into the cabinets (Fig. 4):

**Fig. 4. The Greek authors' CVs in Wikipedia entries at the bottom**

6. Implementation of the virtual library in a 3D environment

In the implementation of our virtual library model we have exploited the 3D presentation and navigation features of the Virtual Collaboration Arena (VirCA) system (http://virca.hu/), (Galambos and Baranyi, 2011) as described in detail in our CogInfoCom paper published in 2013. Now we would like to give a brief description of the main features and concepts of the virtual library model.

From our point of view, the three-dimensional presentation capabilities of the VirCA system are of vital importance. The basic unit in the 3D environment of the VirCA system is a virtual 'room' where we can move in every direction using preferably the corresponding cursor keys on the keyboard (which can be well-known for anyone who has any experiences in playing computer games). In the virtual room we can place almost any 3D objects. They can be examined closely and from every direction when we walk around the room. (NB. a 2D image is implemented as a kind of a 'curtain' through which we can freely go through.) In our case the most important objects are implemented as 'cabinets' (see e.g. the "black boxes" in Fig. 3 and 4) which contain, in a form of a text or image, the selected library content. Of course, the decoration or 'furnishing' of the room can also be very important – especially, when we want to imitate the unique atmosphere of the ancient Library of Alexandria and its environment.

The background picture on the *back wall* of the room shows the reconstructed image of the ancient Library of Alexandria and its former environment. In

addition, as a kind of verbal 'logo', we have used large coloured 3D fonts to display the texts 'Mouseion' and 'Library of Alexandria' as inscriptions (see Fig 5). On the left and right we have placed some informative posters. They provide useful information on the brief history of the Library of Alexandria, its geographical location (with a map of the respective area), the classification system of the ancient library which had been elaborated by Callimachus etc. To help the users in finding the appropriate information, we have put two 'navigators' on both sides pointing directly to the posters and showing what kind of information they provide (Fig. 6 and 7).
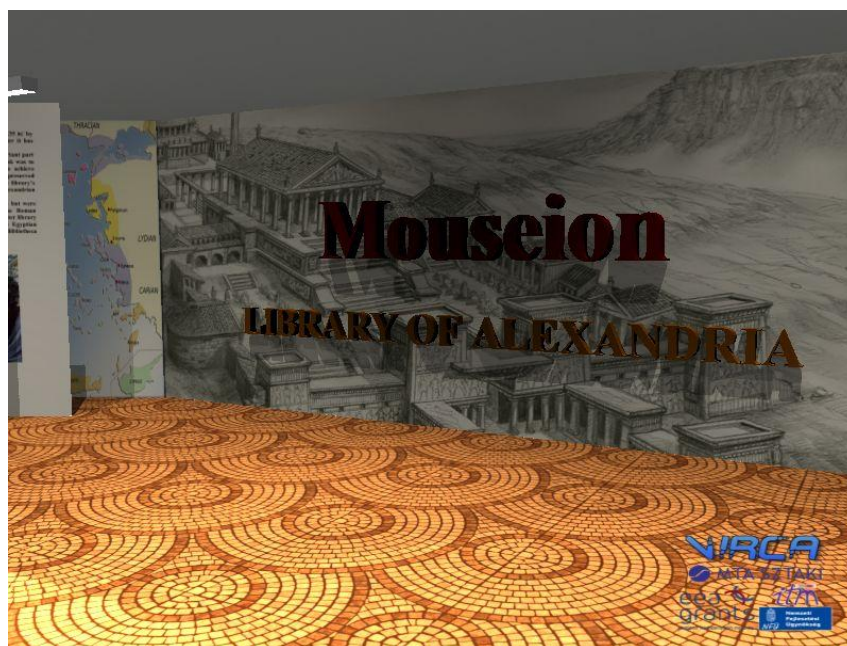
Fig. 5. The back wall of the room representing the 3D library model

We were using ancient patterns to decorate the floor of the library, and tiled the walls from both sides by repeated images of papyrus rolls. Although, of course, there were no such things as electric lamps in the ancient times, we have placed some on the ceiling to simulate – or at least imitate – the former sunlit interior of the ancient library.
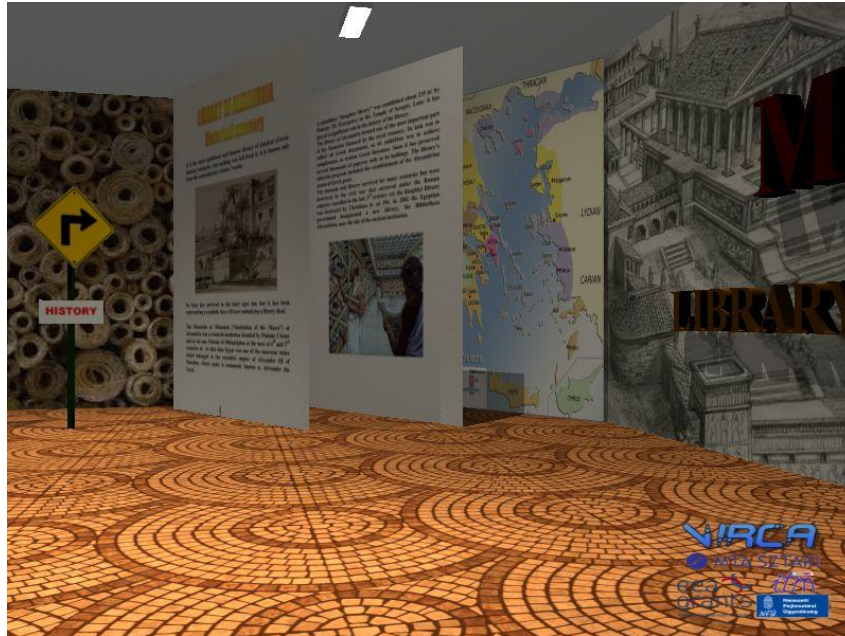
Fig. 6. The informative posters and a navigator on the left side

It is worth emphasizing the realistic implementation of the 3D environment provided by the VirCA system – for example you can clearly see the shadows which the 3D objects (the 3D fonts, the navigator, the informative posters etc.) cast on each other.

g. 7. The informative posters and a navigator on the right side

As we mentioned earlier, the so-called *cabinets* are of vital importance with respect to our virtual library model because they represent the selected library content. Two parallel rows containing a maximum of 18 cabinets are placed in front of the front wall of the room, just opposite the reconstructed image of the library (see Fig 3 and 4). In order that the interior of the cabinets – as well as the texts, images and browser windows that can be found inside – would be well illuminated we have placed a spot lamp on the ceiling of each cabinet.

The front of the cabinets is covered by a curtain or 'veil' (which is, in fact, a 2D image) showing title which identifies the content that can be found in the cabinet. Also, there is a 'label' on top of each cabinet which shows the corresponding category of Callimachus' system (e.g. epic poets, elegists, lyrical poets etc.). These labels, with the images associated with the cabinets (see below), play a crucial role when a user actually want to find the relevant information in the virtual room.

In addition to the texts or images which convey the relevant library content inside the cabinets, there can be a maximum of four images placed on both sides of each cabinet. They could be very useful when a user is looking for some specific information, not to mention their creative potential for suggesting hidden or implicit relationships between or among the presented items. These images could be portraits, paintings, antic sculptures, reliefs, (fragments of) papyri, book covers, ancient maps and so on; their sequences attached to each cabinet can be referred to as 'image corridors' because they directly show the

way to the corresponding cabinets where a user can (hopefully) find the relevant information.

In the three-dimensional virtual space the users can move on purpose, searching for specific information — or just walk around the room and amble along for pleasure, and explore everything they think is important or interesting. They can have a close look at the images and enter into each cabinet and read (or just have a short glance at) its content. Note that one of the great advantages of reading texts in the 3D virtual space is that the users can freely choose the reading distance from the text they are about to read. It is a feature which makes the three-dimensional space, at least concerning readability, an inherently accessible medium because moving closer to the text results in bigger fonts which obviously help the users to read the text more easily (Boda, Tóth and Bényei, 2013).

7. Further improvements and applications

Considering the general approach and robust technologies we have been using it is not surprising that there can be a lot of possible applications some of which has been described in our previous publication on the subject (Boda, Tóth and Bényei, 2013). These applications include e.g. studying the cognitive aspects of our virtual library model; examining the possible contributions of our model to the theory and practice of the spatial hypertext and network research; using our model in various fields of higher and secondary education; our model might be effectively used in teaching and learning foreign languages; using the features of our model in integrated library systems as an alternative way to display library records; etc. Because these applications belong to rather different fields and areas, each application might lead to a significant improvement of our virtual library model.

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