

Digital libraries as samples. Related interface design issues (Extended abstract)

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Although one may think at first glance that "the migration of library material to an online environment using the same paper distribution paradigm [is] a simple technical feasibility issue" [STE 99], we believe that this subject still raises many interesting questions for the research community in information sciences. Perhaps the oldest experiment relevant to the digitization of documents is the photo-telegraph of Arthur Korn (1904). In this apparatus, a selenium cell scans a photograph upon a finite number of lines. The resulting electric signal is transmitted over telephonic wires to a receptor, which in turns activates a mobile light source that illuminates a photographic paper. When examining the quality of reproduction of the facsimile, Korn was well aware of the relationships between the number of scan-lines, the transmission time and the limitations of the wiring technology [BRE 95]. It took however twenty years before Harry Nyquist provided a formal explanation of the sampling process. Basically, the now-called Nyquist Theorem provides a lower bound of the sampling frequency related to the upper-most frequency of the sampled signal. When the sampling frequency falls below the Nyquist limit, the resulting signal exhibits shapes that were absent in the original signal. This phenomenon is called moire, or aliasing.¹

Today's digitization systems are very different of Korn's photo-telegraph, but the very nature of the digitization as a sampling system remains unchanged. In order to avoid aliasing, one must carefully examine the bandwidth of the original signal. Considering the pertinent signals "emitted" by library material as a whole is a difficult task. Examples of underestimation of this parameter are quite frequent, because of technological and/or financial constraints (not to mention naive approaches). For instance grayscale digitization is still being used in most cultural heritage projects, such as the *Conservatoire numérique des arts et métiers* (CNUM, <http://cnum.cnam.fr>), instead of full color. A less trivial example is the treatment of folded plates that were very frequent before the mid-19th century in scientific and technical edition. Plates can be opened and read in parallel with the text pages. It allows the writer to discuss their content without space limitation and the readers don't have to browse back and forth within the book. As far as we know, this feature is lacking in all digital library user's interfaces. Most of the time, this is because of the limitation of the metadata set associated with the facsimile. In the CNUM project, we did label as such plate's facsimile, but didn't consider their ability to be folded and being read in parallel with the main text. One may then consider the resulting facsimile as an alias of the original text. A book is not just a set of (flat) pages, but also a volume and could be modeled as such [CUB 04, CUB 05].

Along with metadata limitations, digital libraries suffer from the WIMP (window, icon, menu, pointer) technique that forms the basis of today's Web-based interfaces. The consultation of multiple documents in parallel is limited by windows overlapping and their constant need for resizing [OHA 97]. As a consequence, most users prefer document downloading and printing. In this respect, Web-based interfaces do not provide much more comfort than the FTP archives in use twenty years ago... With the multiplication of online digital libraries, users

¹ Interesting moire figures can easily be obtained by superposing and moving two celluloid sheets with regular grids of slightly different dimensions.

also deal with a new problem : evaluating the adequacy of these collections with their documentation needs. To estimate the value of a corpus, users usually submit queries to a search engine. This implies of course the user's capability to enunciate such a query. How therefore is it possible to stroll in a digital library ? What visualization techniques should be used when the size of the digital holdings may reach a million items ?

A shift from one - dimensional (text based) interfaces to volume, that real time 3D technology now enables, may help to increase the communication flow between digital libraries and their users. Many authors have studied browsing through library collections with a virtual reality approach. A complete 3D environment is described in the *Web Forager* project [CAR 96]. In this interface, the documents ("Web books") are the main elements and arrangement tools are produced on demand as secondary pop-up resources. In our own work, we followed a somewhat different approach [CUB 02]. The collection is the main element of the interface since the user may need to explore it totally. It is represented by a cylindrical shelf, eventually very large, with books backs or cover apparent. The user is placed in the center of the cylinder and can rotate his/her point of view or move closer to the shelf. The shelf can be re-ordered at user's will, for instance, with subject and chronological ordering. Selected books are represented and manipulated by a new metaphor. It consists in a flat double page surrounded by a tripod that acts like a lectern. Turning the pages interactively is possible with this simplified 3D book structure. Zooming and positioning facilities allow the user to organize its reading environment quite easily. Many opened books can be displayed with a minimal overlapping, depending on their zoom factor. The 3D reading software is currently being tested with a dedicated workstation that combines an immersive hemispherical display and a tactile screen used for the detailed interactions with a single selected document.

References

- [BRE 95] J.C. Brethes. Histoire de la télécopie. PUF, 1995. (pp. 27-35)
- [CAR 96] S. K. Card, G. Robertson, W. York. The WebBook and the Web Forager : An Information Workspace for the World-Wide-Web. Proc. of ACM CHI'96. Vancouver, Canada, April 1996.
- [CUB 02] P. Cubaud, P; Stokowsky, A. Topol. Mixing browsing and searching activities in a 3D digitalized library. Proc. ACM-IEEE Joint conf. on digital libraries, Portland, June 2002.
- [CUB 04] P. Cubaud, J.F. Haas, A. Topol. Numérisation 3D de documents par photogrammétrie. Actes CIFED'04. La Rochelle, 2004.
- [CUB 05] P. Cubaud, J. Dupire, A. Topol. Digitization and 3D modeling of movable books. Proc. ACM-IEEE Joint conf. on digital libraries, Denver, June 2005.
- [OHA 97] K. O'Hara, A. Sellen. A comparison of reading paper and on-line documents. proc. ACM conf. on Human factors in Comp. Sys. (CHI'07), Atlanta, 1997.
- [STE 99] D. Stern (ed.) Digital libraries. Philosophies, technical design considerations, and example scenarios. Science and tech. libraries 17 (3-4), 1999.