Providing Suitable Information Accesses for New Users of Digital Libraries – Case Study DMG-Lib

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Abstract. In today's information society large collections of data arise by the digitization of various content sources. For example, the DMG-Lib, a digital library to collect, preserve and present the knowledge of mechanism and gear science, contains a wide range of digitized information resources in very heterogeneous media types. A main issue of all these collections is to make their contents available for new users in an adequate way. In case of DMG-Lib, the resources are enriched with various additional information like animations and simulations. Combined with innovative multimedia applications and a semantic information retrieval environment, the DMG-Lib provides an efficient access to this knowledge space of mechanism and gear science, for both experts and laymen.

Keywords: Information retrieval, Exploration strategies, Digital libraries

1 Introduction

Digital libraries around the world are many and varied. The growth in digital libraries including collections of e-books, pictures, audio and video sequences has been phenomenal in recent years [6]. Digital libraries in practice very often include multimedia content but just a few try to link and enrich the documents in order to support information retrieval and users' orientation in the multimedia information space. Furthermore the common storage method for knowledge, mainly in static texts and images, does not comply with requirements concerning an efficient and quick information retrieval.

The Digital Mechanism and Gear Library (DMG-Lib) is a scientific digital library with the objective of collection, integration, preservation, systematization and adequate presentation of information in the field of mechanism and machine science [1, 2]. Currently, the DMG-Lib provides more than 40.000 items of various types like documents, images, movies, interactive animations, CAx models, etc. and the amount of items is still growing with the thinkMOTION project [7].

To offer users a wide variety of opportunities for retrieval and utilization beyond the standard keyword-based search paradigm, the digitized sources are extensively post-processed and enriched as well as cross-linked with various information e.g.

animations, metadata, references and constraint based models. This huge amount of available heterogeneous information sources in the DMG-Lib calls for the implementation of an efficient, uniform and user-centered information retrieval, specific concepts to enrich and cross-link the information as well as adequate tools to work with the information presented.

2   Accessibility of Information

The worldwide information about mechanisms and machines is mostly scattered, difficult to access and does not comply with today's requirements concerning a rapid information retrieval. Most important problems are the amount of information originating from different sources like books, technical reports, functional models or mechanical drawings and the efficiency to retrieve and work with this information.

The DMG-Lib is going to digitize the different information sources so that this still important knowledge becomes again accessible for the public and to offer users a wide variety of opportunities for retrieval and use. In order to meet the users' needs the digital library design is based on the requirements of different user groups like engineers, scientists, teachers, students, librarians, historians and others.

According to the Usability Engineering Lifecycle developed by Deborah J. Mayhew [3] a requirement analysis including expert interviews and user focus groups have been carried out to develop a conceptual model of the DMG-Lib portal. For a user adequate design and implementation the usability of the portal and its modules was evaluated analytically by usability experts as well as empirically by users in several stages of development.

3   Suitable Information Accesses for New Users

The DMG-lib provides access to the mechanism and gear technology for different user groups with specific requirements each on the design of the online portal. For example, engineers are looking for a task specific mechanism, scientists are researching for literature, students are looking for teaching materials, and laymen expect a comprehensible introduction to the subject.

Therefore, different information accesses to the collected information within the portal are offered. Keyword-based searches on all sources or source-specific are possible as well as browsing in the database. Especially for new users of the DMG-Lib a timeline, a virtual museum, hypervideos, history maps, interactive e-books with animations and topic maps are offered, to give them an insight and overview of the diversity of the collection.

3.1   Timeline

The timeline application gives users a multimedia overview of important persons, inventions and publications in the historical development of mechanism and gear

science. Users can switch directly to corresponding information resources in the library, for example available books of selected persons. The timeline offers a chronologically order of information and a new opportunity to explore the collection.
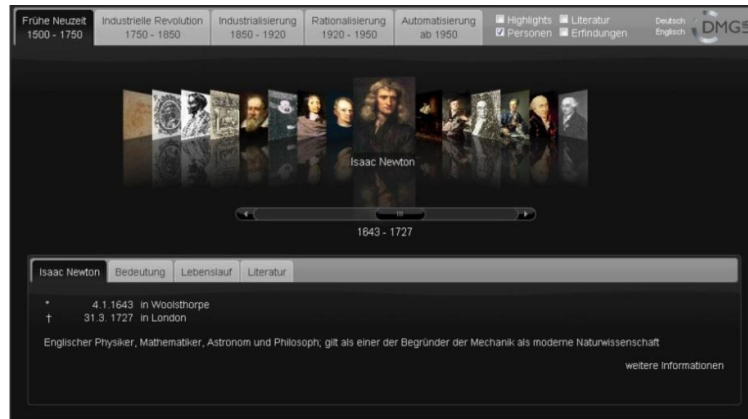
Fig. 1. Timeline application within the DMG-Lib

3.2 Virtual Museum

The virtual museum of the DMG-Lib highlights outstanding items. Thematically different rooms inform about the most important inventions, the development of technology and significant persons of mechanism and gear science. So, users explore rare and bizarre mechanism models or discover mechanisms hidden in daily life.


Fig. 2. Virtual museum within the DMG-Lib

3.3 Hypervideo

A hypervideo is a video stream with embedded hyperlinks on different areas which allow to navigate in the video or to switch to other applications. With the concept of hyper videos an access for new users from the everyday view is created to discover and experience the collection of the DMG-Lib.

The user discovers everyday objects within the videos and takes notice of contained mechanisms by additional information included as hyperlinks. These mechanisms are not obvious in most devices and their principles of operation are little or not known to the user. Therefore, new users find an entrance into the world of mechanism and gear science from a very practical point of view through the hyperlinks to the heterogeneous information sources in the DMG-lib.
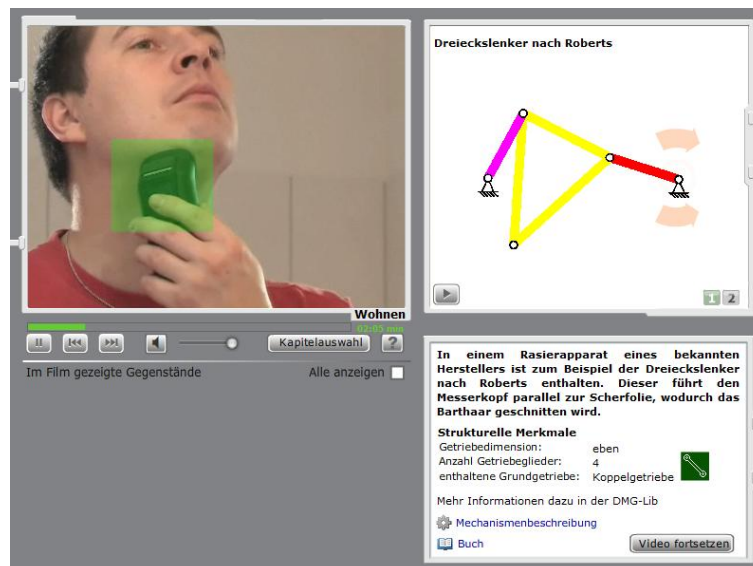
Fig. 3. Hypervideo within the DMG-Lib

3.4 History Maps

The collection of DMG-Lib contains several items described with time and location-based metadata. For example, biographies contain place and date of birth as well as important stages of life career. Mechanism descriptions contain information on date of manufacturing or the current location of collections. Metadata belonging to text documents include the publication date and place. These metadata can be presented in several maps. For example, DMG-Lib history map illustrates a person's road of live (Fig. 4) or shows the locations of all mechanism collections in Germany. The map can also be used to locate search results within the map in addition to a result list.
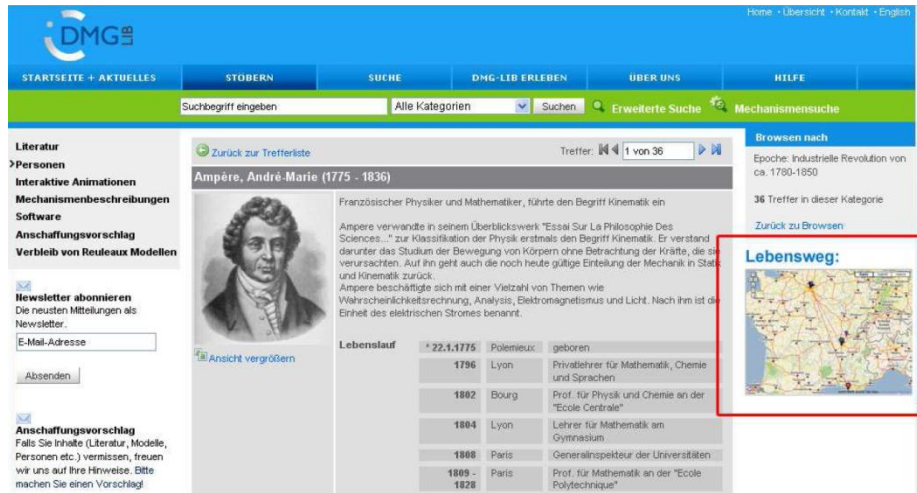
Fig. 4. History map within the DMG-Lib

3.5 Interactive e-books with animations

In the DMG-Lib thousands of e-books are available which contain many figures of mechanisms. To show the movement of the mechanisms selected figures are animated. The animations are integrated in the e-books as overlays. Users can read the text, watch the animation simultaneously and interact with it. Thus, the users have the possibility to gain a better understanding of the mechanism.
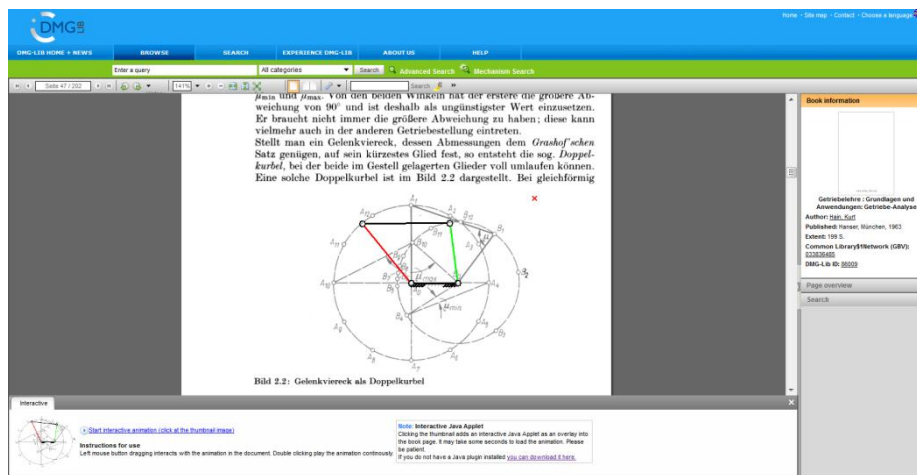

Fig. 5. Interactive e-book with animations within the DMG-Lib

3.6 Topic Maps

A further field of research is the retrieval in heterogeneous information resources using different mechanism and gear hierarchies like the structural system of Reuleaux [5]. Visualization and efficient navigation over these different categories of gears can help users to get a systematic overview over the huge amount of existing mechanism and gear constructions. The stored knowledge can be generalized and explicit modeled in a semantic meta-layer, and visualized with the help of topic maps [4]. Hereby, different hierarchies and relations can be modeled, valid contexts, alternative names and other relevant semantic information can be included, and all relevant information resources available in the DMG-Lib can be linked. This enables users to decide which structuring system he wants to use for navigation.

4 Conclusion

In this paper the various information accesses for different user groups to the DMG-Lib, a digital and interactive library for mechanism and gear science, are presented. Based on the vast amount of available heterogeneous information resources in the library and the extensive enrichment, the DMG-Lib is able to provide an effective retrieval as well as various utilization options for users.

The DMG-Lib supports engineers and scientists in finding ideas for design solutions, detailed structural and functional descriptions, adequate technical terms, historic publications in different languages, etc. Additionally, alternative information accesses help new users to explore the heterogeneous information resources in the library and to discover interests in mechanical engineering.

The DMG-Lib envisions itself as an example of a modern knowledge space aiming at one of the key tasks in today's information society – satisfying user's needs for getting an effective, efficient and custom-tailored access to required information.

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