
The DAISY Standard: Entering the Global Virtual Library

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ABSTRACT

The emergence of the modern information society and the rapid development of Information and Communications Technology (ICT) has spurred libraries serving visually impaired people to cooperate globally in order to manage the transition from analog to digital services. The formation of the DAISY Consortium in 1996 led to the concept and fundamental ideas of the digital talking book. The result is an international standard for digital talking books, which is now becoming a multimedia standard. DAISY has developed new partnerships, new working methods, and new ways of thinking. The digital vision has improved library services to print-impaired people and changed the participating libraries themselves. Today some DAISY libraries are close to becoming fully digitized, and DAISY technology is heading into mainstream use. Users may soon be entering a global virtual library, and the DAISY experience may in many aspects serve as a model for future library developments.

INTRODUCTION

Imagine entering a library without a single physical lending item on the shelves, without books in print, actually without shelves, just large cooled servers, whirring digital archives linked through digital networks with machines for copying and distribution. No whispering, no shushing. It is not science fiction or the librarian's nightmare. It is actually a dream come true.

The DAISY Consortium¹ was formed in 1996 to take advantage of new digital opportunities. For more than a decade now, modern society has been defined as an "information society"—a society in which both low-cost

information and Information and Communications Technology (ICT) is in general use. Today it is more often defined as a “knowledge society” to stress the fact that the most valuable asset is investment in intangible human and social capital and that the key societal factors are knowledge and creativity.²

Knowledge has become the most important capital in the present age, and the success of any society lies in harnessing that capital. Not just economics, but also social, cultural, and all other human activities are dependent on a huge volume of knowledge and information. Modern society is characterized by the ability to identify, interpret, produce, process, transform, disseminate, and use information; to make informed choices; and to share information and knowledge through effective networking mechanisms.

The ability to take part in these processes has become an even more crucial precondition to participate in social life. Being able to use, read, and understand communications is not only a precondition to participate in social life; it is also a key to quality of life for the individual. Not being able to read or write at the same level as everybody else is a serious disadvantage in the knowledge society.

Information and knowledge have always been vital components in the formation of society. Every society is formed around some shared concepts, but one of the contributions of globalization and new ICT is the creation of a global society with a shared knowledge of issues and possibilities. With present day technologies, knowledge societies need not be constrained by geographic location because technology offers many more possibilities for sharing, archiving, and retrieving knowledge.

In general such a society presents great opportunities: it can offer new employment possibilities, more fulfilling jobs, new tools for education and training, easier access to public services, and also increased inclusion of disadvantaged regions or people. It also presents new challenges, however; the transformation of existing social structures and of global economies to knowledge economies does not guarantee economic growth with “equity” either within or between nations as knowledge becomes a much-valued resource to be possessed and harnessed for its economic benefits.

At a very early point in the development of the DAISY concept talking book readers from many countries were consulted regarding their reading requirements and their vision of a fully accessible audio book. Their comments made it clear that analogue recordings did not adequately meet their reading and information needs. Poor access to points within the book, awkwardness of the medium itself, poor sound quality, and other daily annoyances indicated that producers of talking books had to begin the move to a digital platform.

People having trouble with reading and writing face problems in modern daily life, where manuals for household tools, informative labelling,

and letters from authorities are commonplace. It is possible, but definitely not easy, to manage a life with very little reading, but there is a risk of social exclusion as access to print or virtual text is an essential key to almost any form of training and education.

Libraries providing services to people with print disabilities have recognized the challenges and opportunities created by the knowledge society and are acting to make a difference in this changing environment. Digitization has spurred the formation of the DAISY Consortium, a global initiative to manage the transition from analogue to digital library services to visually impaired people. Digital formats provide new possibilities to counter the risks of social exclusion of print disabled people and promote equality in access to information and knowledge.

The conversion to digital services may benefit large numbers of people. Globally, in 2002 more than 161 million people were visually impaired, of whom 124 million people had low vision and 37 million were blind. These global estimates produced by the World Health Organisation (WHO) are considered the best scientific estimates of the global burden of visual impairment (WHO, 2004). However, the actual global magnitude of visual impairment is greater. Worldwide, for each blind person an average of 3.4 people have low vision, with country and regional variation ranging from 2.4 to 5.5. Visual impairment is not distributed uniformly throughout the world. More than 90 percent of the world's visually impaired people live in developing countries.

In the knowledge society, the much broader concept of print disability may actually even be more relevant than visual impairment. The definition of print disability can vary from country to country, but generally print disability may be defined as the inability to access information in a print format due to either a visual, perceptual, or physical disability. Examples may include blindness, dyslexia, learning disabilities, or the inability to hold a book, follow a line of print, or focus and concentrate.

Everyone must have open and timely access to information and knowledge to ensure equality, social inclusion, and a society where all forms of knowledge get recognized and valued, and to provide everyone with the opportunity to a higher quality of life. Social inclusion is fundamental in all democratic societies; everyone should have the same rights and opportunities to participate in cultural, economic, and community life. Societies must recognize situations in which certain groups are put at a disadvantage and make a commitment to eliminate inequality and discrimination by facilitating the process of removing barriers. Nobody should be excluded for reasons of aptitudes or disabilities.

This obligation, confirmed in and defined by the right of access to information in the United Nations International Covenant on Civil and Political Rights, Part III, Article 19(2), is as important as ever: "Everyone shall have the right to freedom of expression; this right shall include free-

dom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice" (United Nations High Commissioner for Human Rights, 1966). The exercise of this basic human right can be severely hampered by the inability to use conventional print due to a visual, learning, or neuromotor disability. People with disabilities that prevent them from reading print have long been deprived of access to the same information as the rest of the population.

The invention of the printing press increased the availability of written materials for the majority of people, but it also served to create new barriers to information for print impaired people, who found themselves excluded from the world of print information. The invention of braille and other tactile reading systems partially helped those who were blind, but its expense and bulk limited its usefulness. In the twentieth century radio and recordings have helped narrow the gulf, but the information highways and the computer have truly created the possibility of a new world of access to information.

For the last decade publishing has been undergoing a revolution. Web-based publishing, electronic publishing, and multimedia presentations have all contributed to a new and different understanding of the term "to publish." When information is digitized and managed by computers, it can be manipulated in many ways. Visually impaired readers can use software that enlarges the display on the monitor to permit them to read it. Speech synthesizers can speak the material on the screen for the reader who is blind. Other input devices permit people with motor impairments to operate a computer and to move through the text without having to hold a book or turn pages. Voice recognition systems can operate a computer. Many new options are available to people with visual or motor disabilities.

At the same time, different communication devices are merging; computer, phone, radio, stereo, and television are becoming one multipurpose device or, rather, many kinds of new devices. Digital technologies are also changing the systems for disseminating information. Stores, libraries, and postal delivery still play an important role when people are acquiring or searching for information, but the complex global network of phone lines, cables, and satellite transmitters—the information highway—has become a major mechanism to bring the user and the electronic text together.

THE DAISY CONSORTIUM

Ten years of high-speed technological development have passed since the formation of the DAISY Consortium. Advancing technologies and supporting standards are now making it possible to meet fundamental human needs in the information or knowledge society—needs that could

not be accommodated in the analog environment. On the threshold of the digital age, libraries serving visually impaired people recognized both this opportunity and the fact that the task was too burdensome and too complex to be managed individually. New ways of thinking and working had to be applied.

The first steps toward the worldwide transition from analog to digital talking books were taken in Sweden in 1988, when the Swedish Library of Talking Books and Braille (TPB) initiated a project to develop a digital talking book. In 1991 TPB saw the need to adapt to new digital technologies. This talking book software was built on the DAISY concept (Digital Audio-based Information System), which specified the demands that needed to be met to create a functional, high-quality digital talking book. The core of the concept is the phrase-based storage of audio. Additional requirements for the system were

- ability to skim the text, phrase by phrase or section by section, where each section is a collection of phrases;
- ability to search for different elements in the text-based table of contents;
- ability to search for specific pages in the talking book;
- ability to place and search for bookmarks in the book; and in a future version,
- ability to “underline” and make notes in the talking book.

The first prototype of the Swedish DAISY Playback for Windows was presented in 1994 at the International Conference on Computers Helping People with Special Needs (ICCHP) Conference in Vienna. At the same time, worldwide interest in creating a new common format for talking books was growing, and it was generally acknowledged that the nature of this task called for international cooperation. In 1995 various institutions interested in new digital techniques met in Toronto, and the Japanese company Shinano Kenshi/Plextor presented their vision of a DAISY-specific digital talking book player.

Based on close professional relations developed through many years of cooperation within the Libraries for the Blind Section of the International Federation of Library Associations (IFLA) a number of national talking book libraries and organizations decided to form an international consortium for the promotion of a new digital talking book standard based on the DAISY concept. The DAISY Consortium was formally founded in May 1996 in Stockholm to establish a de facto standard for digital talking books for print impaired people and for commercial audio books. The concept of the DAISY digital talking book (DTB) became reality.

Initially, the international DAISY Consortium included member organizations from Japan, Spain, Great Britain, Switzerland, Holland, and Sweden. Since then the Consortium has been constituted as a not-for-profit

association under Swiss law. Today this targeted international cooperation has managed to pool the relatively limited resources and expertise available within a niche area and to create the critical mass essential to success. The Consortium has literally become a large cross-sectoral partnership that consists of Full Members, Associate Members, and Friends. A board of twelve members and several highly qualified staff members around the world take care of daily business.

During recent years membership of the DAISY Consortium has grown at a rapid rate; currently, close to 40 countries are represented within the Consortium. There are 12 Full Members, some 45 Associate Members, and around 60 Friends. It is estimated that hundreds of thousands of unique DAISY books have been produced by participating Consortium member organizations. Full and Associate Members of the DAISY Consortium are nonprofit organizations, typically national talking book libraries or national consortia of such libraries, while profit-making organizations are associated as Friends.

It is the vision of the DAISY Consortium that all published information be available to people with print disabilities at the same time as printed versions, and at no greater cost, and in an accessible, feature-rich, and navigable format. The DAISY Consortium's mission is to develop the international standard and implementation strategies for the production, exchange, and use of DTBs in both developed and developing countries, with special attention to integration with mainstream technology, and to ensure access to information for people with print disabilities.

To guide its efforts the DAISY Consortium has identified five major goals, which are

- to create and promote the worldwide standard for the navigation and structure of digital talking books;
- to encourage and foster the establishment and development of digital talking book library services in both developed and developing countries;
- to maximize the accessibility and utility of electronic books and multimedia documents for people with print disabilities;
- to secure the recognition and adoption of the DAISY standard for navigable multimedia documents among mainstream product developers and book publishers; and
- to encourage and foster the establishment and development of a global talking book library that transcends geographic boundaries and linguistic differences and that embraces cultural diversity.

The DAISY Consortium makes a special effort to strengthen access to information for visually impaired people in developing countries, being those countries housing the vast majority of visually impaired people in the world. DAISY for All (DFA)³ is a project that deploys DAISY technol-

ogy and focuses on capacity building of groups in developing countries and on generating broader alliances that will support the global sharing of human knowledge in the information society.

The DFA objective is to encourage production and dissemination of DTBs and to provide information in an accessible format to visually impaired people in developing countries in their local languages. This is done through creation of content and by developing playback and talking book authoring tools in local languages. DAISY for All is primarily funded by the Nippon Foundation and has activities in Bangladesh, India, Malaysia, Nepal, Sri Lanka, and Thailand, among other places. Further activities are planned in Latin America and Africa.

THE DAISY STANDARD AND TECHNOLOGY

Today the DAISY standard is widely recognized as the ideal approach to providing navigable and accessible information to people with print disabilities. A standard is, by definition, a specification of requirements that has been approved by a recognized standard-making body (*de jure*) or accepted for convenience as a standard by an industry (*de facto*). Standards exist in all fields of technology: for programming languages, operating systems, data formats, communications protocols, and electrical interfaces. The acronym DAISY is often used to refer to a standard for producing accessible and navigable multimedia documents. In current practice, these documents are digital talking books, digital textbooks, or a combination of synchronized audio and text books.

The DAISY standard is widely accepted as a *de facto* standard, but the initial and continuing aim of the DAISY standard is to become a fully international *de jure* standard, and to that end, the DAISY Consortium is planning to move this standard toward adoption by the International Standards Organization (ISO). There was a major breakthrough in progress toward this goal in April 2005, when the DAISY standard was approved as a national standard by the formal standard-setting bodies recognized in the United States, the American National Standards Institute (ANSI), and the National Information Standards Organization (NISO). The American National Standard defines the format and content of the electronic file set that comprises a DTB and establishes a limited set of requirements for DTB playback devices.

The American DAISY standard is based on several recommendations of the World Wide Web Consortium (W3C). To ensure development at the lowest possible cost, DAISY technology is, to the widest possible extent, based on well-known and approved technical standards. There is no point in reinventing what has already been invented. This has made it possible for the fairly small niche area of library services to visually impaired people to keep pace with mainstream technological development.

The recommendations of the W3C currently include Extensible Mark-

up Language (XML) and Synchronized Multimedia Integration Language (SMIL). Both of these are internationally recognized standards accepted in the technology industry. The versions in use may vary, depending upon the available technology and other factors. Hardware and software in use today implement the DAISY 2.02 standard; however, over the coming years product and service providers will be making the transition to comply with specifications as outlined in DAISY 3, the ANSI/NISO Z39.86 2002 standard.

In 2003 the DAISY standard was used in the United States to establish a national digital file format for instructional materials for students with disabilities, namely the National File Format (NFF). This was a significant endorsement of the DAISY standard, as it may serve as an inspiration for other countries working to establish an accessible national file format. Since the beginning of the 1990s many different bills were passed in the United States to ensure the provision of digital files to facilitate braille production. One of the major difficulties has been the lack of a standard file specification that publishers can use to deliver the files. Hundreds of different file formats were noted in the various pieces of legislation, and none were fully specified. The need for a common national file format was widely recognized, and in 2003, the DAISY 3 (ANSI/NISO Z39.86-2002) XML DTD (Dtbook) was selected as the format to use. In 2004 this standard was adopted as the National Instructional Materials Accessibility Standard (NIMAS) and incorporated into a new Individuals with Disabilities Education Improvement (IDEA) Act.

The DAISY Consortium is constantly working to improve DAISY technologies. Typical consortium projects are based on partnerships between two or more organizations, institutions, or companies situated in various locations around the globe. This working method builds on mutual trust and shared dedication and can be both risky and hard to manage, but it is the only way forward, necessitated by the complexity of the matters involved and the relatively limited resources of the individual Consortium members.

The Urakawa Joint Project is an example.⁴ The Consortium has identified a global need for better ways to create high-quality multimedia authoring software, and a project was launched aiming to advance worldwide open, nonproprietary standards for multimedia that are fully accessible to people with disabilities. The DAISY Consortium, the French National Institute for Research in Computer Science and Control (INRIA), the Centre for Mathematics and Computer Science (CWI) in the Netherlands, and National Rehabilitation Centre for Persons with Disabilities (NRCD) in Japan, have engaged in the development of a multimedia authoring software framework that includes an object-oriented abstract data model, an Application Programming Interface (API), a code library, and at least one sample application.

The Urakawa project will create a software development framework that can be used by anybody to build multimedia authoring applications. The product will be open source, royalty free, and available under licensing terms that will encourage commercial and noncommercial companies to build on the API and code library. Synchronized Multimedia Integration Language (SMIL) and the DAISY/NISO Standard are the main specifications identified within the application domain.

THE DAISY DIGITAL TALKING BOOK

The actual DAISY product—the DAISY book or the digital talking book—is, in short, a multimedia representation of a print publication. For many years talking books have been made available to print disabled readers on analog media, first on phonograph records and then on audiocassettes. These media serve their users well in providing human speech recordings of a wide array of print material in increasingly robust and cost-effective formats. However, analog media are limited in several respects when compared to a print book. By their nature they are linear presentations, which leave much to be desired when reading reference works, textbooks, magazines, and other materials that are often accessed randomly.

The era of library services offering talking books on tape is marked by limited and delayed supply, cumbersome working procedures, and troublesome products; talking books on tape are quite usable but not adequate and somewhat drab in the eyes of the user. DAISY DTBs meet talking book readers' requirements by providing access to the talking book in a way that has never before been possible with a human voice production of a print book. It offers the print-disabled user a significantly enhanced reading experience much closer to that of the sighted reader using a print book.

DTB users are able to navigate through a DAISY book by moving between the headings, chapters, and pages. Depending upon how the book is produced, images with descriptions may be included, along with even more detailed navigation. Reading devices for these materials enable users to place bookmarks for later reference.

The DTB goes beyond the limits imposed on analog audio books because it can include not just the audio rendition of the work but the full textual content and images as well. Because the textual content file is synchronized with the audio file, a DTB offers multiple sensory inputs to readers, a great benefit, for example, to learning disabled readers. Talking book users have long complained that they do not have access to the spelling of the words they hear; now users can listen to a book while reviewing the print book if they wish.

Books consisting of navigable audio files may be accessed with a portable player or via computer. Such books with a significant portion of text offer a user the choice of closely examining the text using a computer equipped with synthetic speech, a braille display, or via screen-enlarging

software. Digital talking books are not tied to a single distribution medium. CD-ROMs will be used at first and most often, but DTBs will be portable to any digital distribution medium capable of handling the large files associated with digital audio recordings and can even be transmitted through the Internet.

Even people who do not have a print disability may benefit from reading books that use the DAISY standard. Books that take advantage of the DAISY standard offer an eyes-free reading experience without sacrificing the ability to skim and note passages of particular interest. DAISY books that include an electronic version of the text can also be searched with ease. These reading experiences can be equal to or better than the experiences of those offered by reading traditional books or by conventional commercial e-books.

The DTB, like analog talking books, renders the audio in human or synthetic voice; it has been summarized by Thomas Kjellberg Christensen and Margit Dühring (2006) as a set of digital files that includes

- one or more audio files containing a human narration of part or all of the source text;
- a marked-up file containing some or all of the text (strictly speaking, this marked-up file is optional);
- a synchronization file to relate markings in the text file with time points in the audio file; and
- a navigation control file that enables the user to move smoothly between files while synchronization between the text and audio is maintained.

Additionally, the DTB can contain image files, and a forthcoming version will also include a video playback capability, as the standard is to become a multimedia product offering a wide range of features in order to provide services to a broader audience, including, for example, deaf and hearing impaired people. The audio file must be either in WAVE, MPEG-1, or MPEG-2 Layer III (often denoted MP3) or MPEG-4 AAC format. The text of a book is marked up in Extensible Mark-up Language (XML), a World Wide Web Consortium (W3C) standard somewhat reminiscent of HTML, the language used for Web pages. For use in digital talking books, the XML mark-up must adhere to a specific Document Type Definition (DTD) defining the “legal” building blocks of the XML file. The DTD for a DTB is publicly available through the DAISY Web pages.

The synchronization is mediated by Synchronised Multimedia Integration Language (SMIL) files, which ensure the parallel presentation of the text part and the audio part of a DTB. The SMIL files for DTBs follow a DTD of their own. SMIL is a W3C standard.

The Navigation Control Center (NCC) consists of a Navigation Control File for XML Applications (NCX) file, which is an XML application structured in accordance to a separate DTD. The NCX contains navigation

points for both text and audio and can be likened to a table of contents. Each navigation point in the NCX is linked through a SMIL file to the corresponding location in the audio and XML textual content files, providing direct access to that location. The NCX controls the global navigation and provides access primarily to relatively large parts of the document. The NCX provides an overview of all the points in a text to which a user may navigate and offers direct access to selected structures in the book such as page numbers, notes, and figures. Once an NCX item has been selected, local navigation—such as movement within a list or table, or among a group of words, sentences, or paragraphs—becomes possible.

DAISYDTBs are not required to contain all of the possible constituents mentioned above. The different combinations of elements have given rise to six types of DAISY DTBs. Of the six types, four offer improved access and human voice delivery through links between the digital audio sound files and the marked-up text files. It is these links that give the talking book reader access to the structure of the book; these links are the key to a DAISY DTB.

As defined in the DAISY structure guidelines, the six categories of DAISY types of DTB are the following:

1. Full audio with title element only
This is a DTB without navigable structure. Only the title of the DTB is available as text, and the content is presented as linear audio only. Direct access to points within the DTB is not possible.
2. Full audio with Navigation Center (NCC or NCX) only
This is a DTB with structure. The structure is two-dimensional, providing both sequential and hierarchical navigation. In many cases, the structure in this type of Daisy DTB resembles the table of contents of its print source. Some of these productions provide page navigation.
3. Full audio with Navigation Center and partial text
This is a DTB with structure as described above, as well as some additional text. The additional text components may occur where keyword searching and direct access to the text would be beneficial, for example, for the index or glossary. The audio and existing text components are synchronized.
4. Full audio and full text
This is a DTB with structure and complete text and audio. The audio and full text is synchronized. This type of production may be used to generate braille.
5. Full text and some audio
This is a DTB with structure, complete text, and limited audio. This type of DTB could be used for a dictionary where only pronunciations are provided in audio form. As in the previous categories, the audio and text are linked.

6. Text and no audio

This is a DTB containing a Navigation Center and marked-up/structured electronic text only. No audio is present. This file may be used for the production of braille.

DTBs produced to the DAISY standard are in and of themselves independent of distribution medium, that is, the digital master file can be archived and may also be distributed on currently available media such as CDs or DVDs. More importantly, as technology advances and digital media distribution methods evolve, these same books can be distributed via the newly developed media or system. The types containing text may also include images.

There are currently three ways of listening to a DAISY DTB, either through a special DTB hardware player or through special software on a computer or with an MP3 or DVD player. With the two latter players it is not possible to use the full structure of the DTB, but the user can listen to the DTB and have a very simple way to linearly jump forward or backward in the book between navigation points. This could be, for example, jumping from paragraph to paragraph, but it could just as well be from a chapter to a page to a paragraph as these players do not differentiate between the different kinds of navigation points. Additionally, to use these two players the audio files in the DTB should be stored in the right order, which is not always the case.

In the process of the DAISY Consortium's work with developing both the standard and the production tools for DTBs, developers of players have been involved from the very start. This means that today there is a range of vendors on the market offering accessible players. Of the various types of players on the market, some are very simple and function very much like ordinary old-fashioned cassette players and offer a limited possibility of navigating the structure of the book. Other players are very sophisticated and enable the user to fully utilize the structure and the navigation features of the DTB, such as the ability to move to a specific page or paragraph and to insert bookmarks. Some software players display the text on the screen, for example, in large print, while the text is read aloud.

A CASE STUDY: THE DANISH NATIONAL LIBRARY FOR THE BLIND

Digital talking books provide steps into the future, and as analog technology is phased out libraries are obliged to change. The Danish National Library for the Blind (DBB) set out to complete a full transition from analog to digital DAISY technology before the end of 2008. At present, DBB offers print-impaired users a selection of 12,000 digital audio book titles, 1,200 e-books, and a couple of e-newspapers. In the years to come, more

digital content will be at the heart of DBB's approach, and the strategy to succeed is the formation of partnerships with libraries, library portals, and other providers of information.

The goal is to move forward as quickly as possible with the implementation of truly digital processes, which implies, among other things, higher speed—and lower costs—in production and improved individual user service. DAISY technology provides better books with high sound quality, numerous facilities for users, and lower production costs per unit. In principle, users can choose between talking books, e-books, and braille books without a significant cost increase in the process of production.

As it moves into a new life with DAISY, DBB has introduced the key concept of the digital mindset, which focuses on the ability to understand and make maximum use of the potential of technology. The library is striving to be constantly aware of setting off from a digital starting point and at the same time unlearning all those ways of thinking, conventions, and traditions tied to analog technology, which are losing relevance as it is phased out. All aspects of library operations must be reinvented in a new digital context.

Today the consequences of the digital revolution within DBB are obvious in the production process, with computers ready to produce copies on demand day and night, and in the range of opportunities provided by digital formats. Less conspicuous is the gradual transformation taking place in the minds of library employees: the transformation into the digital mindset and the learning process necessary to enjoy fully the benefits offered by digitization in terms of resources and convenience.

The essence of the digital mindset is accepting that the complexity of the digital environment is here to stay but also that complexity does not equal chaos. The digital world may seem chaotic, uncertain, ambiguous, and even paradoxical, but the many new options offered by technology are also stimulating and challenging to human creativity and mental capacity. The implementation of a digital mindset is not meant to reduce the range of options or complexity, but it is, rather, a way to prioritize the continuing process of training and development that enables all members of the organization to think and act within the logic of a digital world. It is a constant reminder of the need for digital innovation.

The DBB virtual Internet library is an example of digital mindset adopted in practice. Today the online portal of the DBB—named E17—is an integrated part of the everyday library service. Users can search the library collections and order the materials available by e-mail or directly download e-books in different formats. They can interact through virtual bulletin boards and recommend books to each other. The virtual library is equipped with comprehensive navigation facilities especially designed for DBB's user groups. The contents on E17 can be read aloud in synthetic speech through the program WebReader, which was developed by DBB.

Another example of the digital mindset is the abolition of a key activity in conventional, and even modern, libraries, namely, library lending practice. Digital materials are now produced and distributed on demand and may be kept by the user. This new practice is based on new exceptions in Danish copyright legislation, which have been endorsed by DBB and relevant partners. The next step will be to download DAISY DTBs as well as e-books. The result of digital on-demand distribution is a reduction in the cost of transportation of materials. Furthermore, the library no longer needs resources to receive, handle, and return materials to the shelves.

In return for granting permission to use and keep their materials, publishers have demanded a renewed guarantee that digital material is not distributed through unauthorized sources. This request is met by allocating all library users an ID number, which is integrated in the digital materials as part of the process of production on demand. Materials delivered on CD are also marked with the postal address of the receiver. Should materials from the library be unlawfully distributed, the ID number can be used to identify the source of the abuse.

In 2006 materials containing sound will also have digital watermarks installed, which can identify the user who received the material. Methods of encrypting materials specifically for individual users are being developed. Both watermarks and encryption to a specific user can be added to the material. The development of a Digital Rights Management (DRM) standard and tools is being conducted under the auspices of the Daisy Consortium.

DBB's transition from analog to digital technology is being made step-by-step. This approach has proven to have advantages and disadvantages. It has been an indisputable advantage that new products and forms of distribution have been developed in an iterative process, for example, tests involving limited groups of users have been carried out in various pre-projects. Consequently, both users and DBB have gained a solid and relevant experience, which endows the ongoing transition with a convenient overview and a sense of confidence.

However, the costs of running double lines of production for several years have been significant. DBB plans to enroll 3,500 more digital users in 2006 and the remainder in 2007. By the end of 2009, expectations are that there will be 15,000 individual digital users compared with 10,000 today. It is most likely and highly desirable that DAISYDTBs and new digital services will attract more print-disabled library users.

THE FUTURE OF DAISY

The DAISY experience is quite exceptional within the global library community. It has developed new partnerships, new working methods, and new ways of thinking. It is an extraordinary example of targeted global cooperation, not just among libraries but among commercial partners as well as universities and other groups of experts. It may be seen as a stepping stone

for libraries entering the digital future and as a means of exploring core library issues, such as management of digital media, handling of copyright, and exchange of global content. The DAISY Consortium has successfully influenced market developments to the benefit of library users.

In some DAISY members' countries the efforts of the international Consortium are now supported by national DAISY organizations working to promote the DAISY vision and mission. DAISY members in Germany, Japan, Sweden, and Switzerland have established such organizations, whose members are often regional public libraries, university and research libraries, organizations, government authorities, and magazines offering, or interested in, services to visually impaired people. In the United Kingdom a special DAISY fundraising unit has been created, and in the United States plans are to establish a similar national fund for DAISY.

The expansion and consolidation of the DAISY Consortium and DAISY technology has created a platform for the management and safeguarding of copyright, an important issue that can only be handled with an international perspective. Most entities distributing books for blind and print disabled people using the existing DTB standards are required by law to apply some sort of protection, up to and including stringent encryption and watermarking systems.

Copyright is not just a legal matter nor only about trade politics: it is an issue involving common social interests such as democratic rights and educational and cultural policies. The battle of business in the digital environment is still intensifying. The rules regulating traffic on the digital highways and the rights of those travelling there are still politically debated.

The fair balance of copyright, between the protection of creative works and access to information and knowledge, is delicate. In any case, the copyright holders and publishers whose works are being distributed wish to see those works protected in a way that prevents their dissemination to unauthorized users. At the same time, end users of those works expect reasonable rights to the use of those publications. The requirement is a minimally invasive system that balances equitably the rights of end users with the protection requirements of copyright holders, publishers, and local copyright law.

The development of DAISY technology has been necessary to give groups with information deficits the full benefit of the new potential of digital technology. The citizens of the learning society need DAISY technology, not least those with information deficits. In Denmark and other countries, DAISY technology is now widely used by people with dyslexia. They can listen to a book while reviewing the printed text on screen if they wish, which is a great help in spelling the words they hear. Today some of these people with dyslexia even regard the computer as their equivalent to the glasses of the weak-sighted.

Pending copyright developments, an even larger number of people may

make use of the technologies and services designed for visually impaired people. Even in the wealthy Western societies with the highest levels of education, the number of functional illiterate people—defined as individuals who are unable to use reading, writing, and computational skills in everyday life to, for example, fill out a job application, read traffic signs, read a newspaper, or understand a school bus schedule—is estimated to be an average of up to 10 percent of the population. These people are not visually impaired, physically handicapped, or dyslexic but rather have problems reading because they have not maintained their acquired reading skills and do not read on a daily basis.

Digital innovation is changing the world and markedly affecting the library universe. It is transforming the traditional concepts of libraries themselves, of printed books, and even of basic text and writing: libraries without printed books, nonprint books without fixed and permanent text, and interactive hypertext combined with sound and images. Well-known forms and shapes have become less clear and more ambiguous. The virtual library is no longer a figment of the imagination.

The accelerating rate of change and an increasingly unpredictable and complex world challenge the old patterns and require lifelong learning and innovative capacity. The concept of the “learning society” emerged around 1970 along with that of the knowledge society. The term refers to a new kind of society in which the traditional transfer of organized knowledge, inside educational institutions and immediately after initial training, no longer applies. Learning is a never-ending process of communication and knowledge—and the ability of individuals to adapt to change is a key factor.

Digitization is no longer a mere buzzword; it has become hard reality, including in the library world. To fully exploit technologies and to maximize their impact, suppliers, distributors and users, and library managers and employees now have to acquire a new and more comprehensive “digital mindset”: thinking digitally and being flexible and innovative. The knowledge society has revealed a new and different reality, displaying a broad range of perspectives for future library development. The digital reality is no longer just a question of e-business or e-service; it is also e-production.

This digital mindset has been a pivotal aspect of all DAISY activities. In the near future, libraries will be able to offer users with disabilities digital products of far better quality and with unique user functionality. Efficiency in service, measured in terms of timeliness as well as costs, will reach an attractive level. And in several ways, the digital library service to citizens with disabilities could indeed prove to be a pilot project for the transformation that is closing in on all parts of the global library community. The general concept of a library may be subject to changes never experienced in the past. The concept of the hybrid library is debated today, but soon users will be entering the virtual library.

DAISY technology can provide users with information directly from

the producer to the mailbox at home. The traditional ways of cooperation between libraries serving people with print disabilities and public library services, which have been functioning in some countries, are changing already. The chain of supply has to be rethought, but the DAISY Consortium still needs close interaction with other libraries and their organizations to remain an integrated part of the global library community and to ensure mainstream solutions.

Initially, the DAISY standard was established and developed to benefit people who are unable to read print due to a disability, but over the years it has also proven to have broad applications for improved access to text for mainstream users. DAISY aims to become part of the mainstream market. Publishers, newsrooms, libraries, educational institutions, and others who need to communicate or disseminate complex volumes of text in user-friendly ways will be able to profit from DAISY technology. The DAISY Consortium encourages commercial suppliers to equip the market with the necessary hardware and software players because even though MP3 players and modern DVDs can be used, full advantage of the user facilities are still only provided by dedicated players. DAISY is reaching out to the commercial sector, and this sector has recognized shared interests.

At a seminar on “Libraries for the Blind and Print Disabled Moving Toward a Digital Future” hosted by then Microsoft Accessible Technology Group (ATG), the ICT icon Bill Gates, Microsoft chairman and chief software architect, said “We ought to be able to connect mainstream issues with special needs, to create a bridge between the two” (Microsoft, 2004). He stressed that “The advantages of accessing different types of digital information on a variety of devices are not limited to the visually impaired. The pioneering work being done to serve their special needs today could have widespread benefits for every user tomorrow—and keeping the two closely connected will help lower costs and speed development (Microsoft, 2004). The DAISY technology will undoubtedly be the cornerstone in the development of the global library for people with special needs, and the technology experience harvested by DAISY membership can prove to be of benefit to other types of libraries. Some special libraries for visually impaired people in the wealthy Western societies will probably be the first fully digitized libraries in the world. They have entered the digital age with open eyes and minds.

NOTES

1. For further information see <http://www.daisy.org/>.
2. The UNESCO World Report *Towards Knowledge Societies* has been used as a basic starting point for this article. It is available at <http://unesdoc.unesco.org/images/0014/001418/141843e.pdf>.
3. For further information see <http://www.daisy-for-all.org/>.
4. For further information see <http://urakawa.sourceforge.net/>.

REFERENCES

- Christensen, T. K., & Dühning, M. (2006). Access to information on demand by the aid of digital talking books. In N. Ichalkaranje, A. Ichalkaranje, & L. C. Jain (Eds.), *Studies in Computational Intelligence: Vol. 19. Intelligent paradigms for assistive and preventive healthcare* (pp. 117–132). Berlin, Germany: Springer.
- Microsoft. (2004, November 15). *Gates stresses value of digital technology in making information more accessible to people with vision or print disabilities*. Retrieved November 21, 2006, from <http://www.microsoft.com/presspass/features/2004/nov04/11-15librarysummit.mspx>.
- United Nations High Commissioner for Human Rights. (1966). *International covenant on civil and political rights*. Retrieved December 1, 2006, from http://www.unhcr.ch/html/menu3/b/a_ccpr.htm.
- World Health Organization. (2004). *Magnitude and causes of visual impairment* (Fact Sheet No. 282). Retrieved November 21, 2006, from <http://www.who.int/mediacentre/factsheets/fs282/en/>.

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