Universal Access to Alternate Media

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Abstract. This paper discusses the need for automated alternate media solutions in a world of increasing mainstream inclusion. While society as a whole is shifting from educational, vocational and social segregation of people with disabilities towards inclusion and equal rights, the need to support the blind, partially sighted, dyslexic and other print impaired with textual material in alternate formats remains. Production of alternate media is non-trivial and subject to significant skills and technical proficiency. However, the shift towards mainstream inclusion also means distribution, dilution and erosion of competencies, practices and experience involved in producing alternate media. RoboBraille, an alternate media conversion service, has attempted to distil the competencies and experience of producing alternate media into a set of automated workflows. While emerging digital media and technical platforms should make it easier to obtain alternate versions of mainstream publications, a number of counterproductive measures work in the opposite direction.

Keywords: Alternate media, inclusion, Braille, e-books, audio books, digital accessibility, universal design, copyright

1 Introduction

Many people with disabilities are unable to use printed material and therefore require alternate versions of the material in order to be able to complete an education, sustain a job or take part in society. The blind require material in Braille, either digital on Braille display or embossed on paper using a Braille embosser. The partially sighted require large-print material, preferably adapted in accordance with individual diagnoses and preferences in terms of enlargement, typeface, colors, contrasts and line spacing. The visually impaired also frequently use audio books. People with dyslexia, learning disorders, poor reading skills or poor language skills need audio books and printed material that has been adapted to individual preferences. People with physical disabilities may need digital editions that can be navigated on e-book readers using switch controls. And the list goes on.

Preparing, editing and converting a mainstream publication such as a textbook, scientific paper, work instruction or patient information leaflet into an alternate format that can be used by a person with sensory, physical or cognitive disabilities is usually a non-trivial task that requires significant knowledge, skills and technical proficiency.

Traditionally, many groups of people with disabilities have been segregated from the rest of society in special schools and, subsequently, in sheltered employment. In

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such specialized environments, it has rarely been a problem to maintain the knowledge, skills and technical proficiency required to convert material into alternate media. However, as societies move from educational, vocational and social segregation of people with disabilities towards inclusion and equal rights, it becomes difficult to maintain these competencies.

In Denmark, the move from segregation towards mainstream inclusion amongst the visually impaired commenced in the 1960s, culminating in 1980 with the abandonment of legislation that had mandated segregated education in previous decades [1]. Similar changes were implemented for other disability groups, and today only a few individuals with multiple disabilities and complex needs do not enroll in mainstream education. For the blind and partially sighted in Denmark, the abandonment meant that rather than attending a special school, all blind and severely partially sighted children and youth were enrolled in their local, mainstream schools. To illustrate the challenge, Denmark has approx. 2.500 primary and lower secondary schools. The number of blind and severely partially sighted children and youth under the age of 18 is in the order of 500. Of these, less than 50 are blind.

Denmark may have been amongst the first countries to engage in this shift from segregation towards mainstream inclusion. Although it can be argued that education levels and employment rates amongst those affected have not improved, the changes have impacted not only primary and secondary education, but also paved the way for inclusion in further education and mainstream employment amongst those with special needs [2][3]. On a universal scale, the shift from segregation towards mainstream inclusion is likely to be adapted as the norm, as upheld in numerous treaties and conventions, most notably the UN Convention the Rights of Persons with Disabilities and the UNESCO Salamanca Statement on Principles, Policy and Practice in Special Needs Education [4][5].

2 The Problem at Hand

Integrating those with special needs into mainstream environments does not remove the need to be able to provide material in alternate formats such as Braille, simple and structured audio books, large-print and e-books. However, such integration does create a significant challenge in how to have material converted, properly as well as timely.

Conversion of material into alternate formats is non-trivial and subject to significant knowledge, skills and technical proficiency. Converting a text-only document into an MP3-audio file may be rather simple. Converting a math exercise into a structured audio book with spoken math equations is slightly more difficult. Converting an anatomy textbook with hundreds of illustrations into a usable Braille book is time consuming and complicated. Depending on the quality of the source material and the required target format, the conversion can be done automatically or it may require significant human value adding.

The core requirement in any alternate media production is the availability of a digital copy of source document. In case of published material, it may or may not be possible to obtain a digital copy of the material from the publisher. Similarly, it may or may not be possible to make use of an e-book version of a publication depending on

local copyright legislation as well as any digital rights restrictions. Otherwise, the typical starting point will be to acquire the book, cut off the spine, run it through a high-speed scanner, convert the scanned file using Optical Character Recognition (OCR) software and edit the final result. Depending on how the document is going to be converted, it must be adapted with varying levels of detail.

Deciding on proper alternate formats may also be complicated. An MP3-file may be easy to create and highly portable as it plays on everything from dedicated MP3 players to smartphones, tablets and computers. Depending on the source material and the situation where the material is going to be used, the MP3-format may be more or less useful. Because of its linear nature and lack of navigational aids, material in MP3 may prove difficult to use in a classroom situation where students must be able to locate specific pages or chapter or section. On the other hand, the same material may be highly useful for students reading it during workouts or while they commute. Similar situational trade-offs can be made on material in a structured audio book format such as DAISY as well as e-book documents and Braille material. The end conclusion is often that multiple alternate formats must be provided.

3 Designing for Alternate Media

Converting a document from one format to another may be a straightforward process or it may require significant editing, modification or value adding. Figure 1 below illustrates the general, hierarchical principles of adapting a document based on best practices at the National Center for Visually Impaired Children and Youth in Denmark:

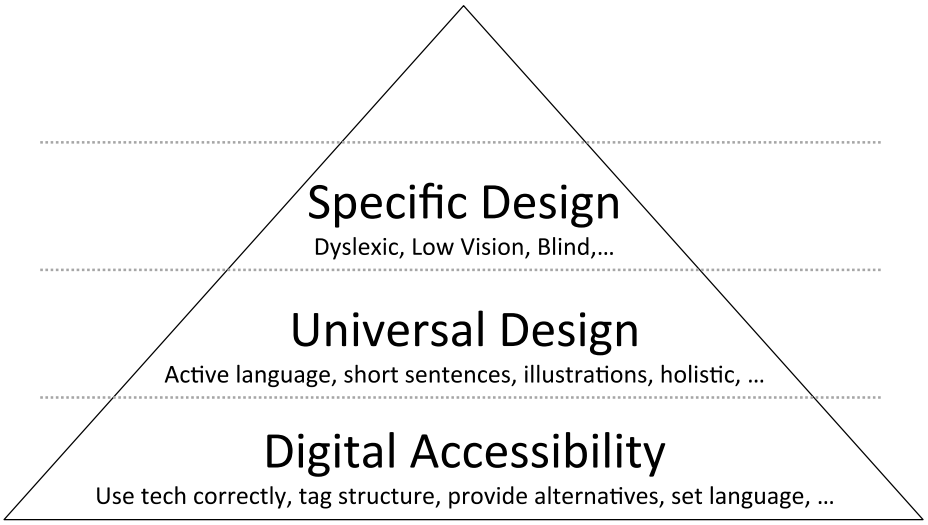

Fig. 1. The Alternate Media Pyramid

At the base of the hierarchy is the requirement that the document complies with the principle of digital accessibility. These principles are generally accepted and docu-

mented by various industry bodies, such as the International Standardization Organization (ISO) and the World Wide Web Consortium (W3C) [6][7]. The purpose of the digital accessibility principles is to ensure that the document can be accessed by as many people as possible, from as many technological platforms as possible, and in as many different situations as possible.

The principles of digital accessibility require the document to be authored properly and in accordance with the specification of the particular document format, that features of the authoring tools not be abused for purposes that these were not intended for, that the semantic structure of the document such as headings, tables, lists and notes be marked up, that alternatives be provided for non-textual contents such as illustrations and graphs, that the natural language of the document as well as any changes to the natural language throughout the document be specified and that the reading order of the document be logical. By observing these design principles for digital accessibility, the document will – at least in theory – be accessible by people with disabilities with or without the use of assistive technology. It also means that the document can be converted and be presented in other modalities than print. However, it does not mean that the document is intelligible.

The middle layer in the hierarchy contains a set of universal design principles derived from general definition of universal design by Ronald L. Mace and others [7]. The purpose of applying universal design principles of document design to the document is to improve the general intelligibility of the document. These principles require the language of the document to be as direct as possible, not to use unnecessary complex language, to use short sentences, to keep accompanying illustrations and text together on the same page or on the same opening and to use a consistent design.

The top layer in the hierarchy is a set of specific adaptations that can be used to support specific users. If a document is being prepared specifically for a reader with low vision, it may make sense to provide it in a high-contrast, large-print format with an easy-to-read, sans-serif typeface. If the ultimate reader is dyslexic or have limited language skills, it may make sense to reduce the complexity of the language even further. If the reader has cognitive disabilities or is illiterate, it may make sense to alter the presentation and substitute contents for pictograms or use a cartoon format. This is also the layer where decisions on supporting material such as tactile graphics, 3D models, soundscapes and similar can be made. Altering the material in such ways, however, is likely to impact the reusability and ability to repurpose the material for other groups of readers.

The Alternate Media Pyramid is applied at different angles by different categories of publishers and material producers. Publishers and media producers with a general audience such as general publishers, mainstream educational institutions, mainstream teachers, public institutions and alternate media producers serving multiple groups of users are likely to start at the bottom and move upwards, frequently skipping the digital accessibility principles. In contrast, special schools, special education teachers, parents and alternate media producers servicing select user groups are likely to start at the top layer and move downwards.

4 Automating Knowledge and Competencies

In Denmark, the decision to include the blind and partially sighted in mainstream education sparked the development of a number of new technologies. As this happened prior to the personal computer, world wide web and e-books, a number of basic assistive technologies, reading platforms and distribution channels had to be developed. Furthermore, technologies that enabled teachers, students and relatives to produce material in alternate formats without any particular skills, had to be created. Throughout the 1980s and 1990s, a number of such technologies were developed and introduced with varying levels. The breakthrough in decentralized material production was the invention in 2004 of RoboBraille, a self-service solution for alternate media. Automating the workflows from the former specialized schools and alternate media production facilities, RoboBraille guides the user through a few simple steps to have documents converted into digital Braille, MP3 audio files, DAISY structured audio books and various types e-books. As an added benefit, RoboBraille can also be used to convert otherwise inaccessible documents such as image-only PDF files or JPG pictures as well as tricky documents such as Microsoft PowerPoint presentations into more accessible, less tricky formats [9][10]. Figure 2 below shows the main interface to the RoboBraille service:

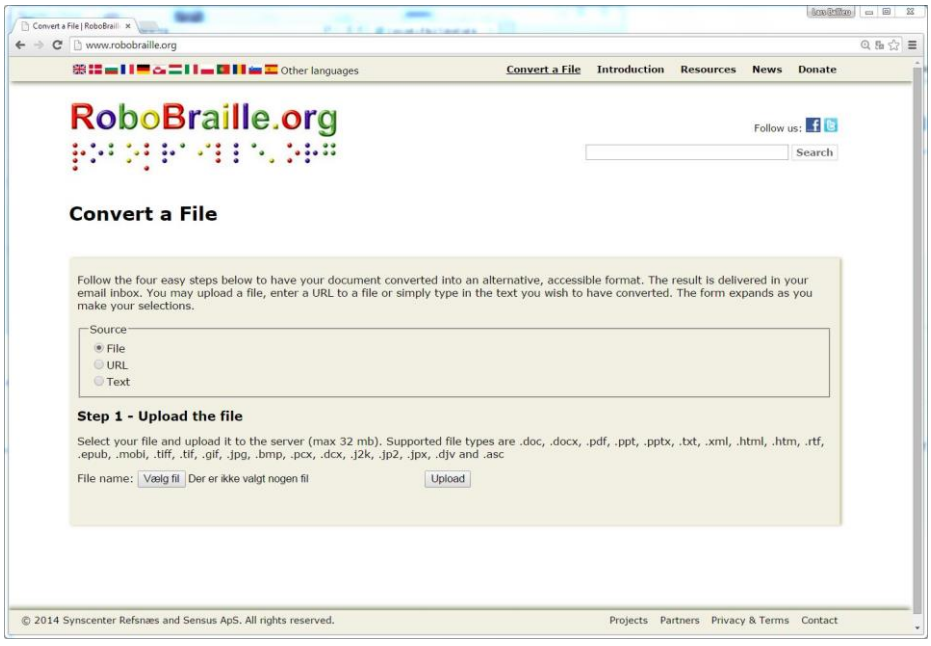

Fig. 2. The RoboBraille service at www.robobraille.org

As an inclusion technology, RoboBraille addresses a number of challenges. Initially a Danish Braille service serving Danish users, it soon became clear that the service could be expanded with more languages and more functionality. By attracting users in other countries as well users beyond Braille readers, it was possible to establish a

critical mass of users while at the same time being able to provide the Danish users with support for foreign languages. Several projects have explored how RoboBraille can be used as an assistive technology as well as a mainstream learning technology [11][12]. Today, RoboBraille remains a free service for individual, non-profit use whilst academic institutions are subject to an annual subscription fee for usage of the SensusAccess interface amongst students, faculty, staff and alumni [13]. The language-specific parts of the service currently supports all main European languages, some smaller European languages as well as American English, Latin American Spanish, Russian and Arabic.

In 2012, RoboBraille was complemented by a digital library that allows alternate media producers to distribute material in alternate formats in a controlled manner, thus automating the former manual practices and workflows for material distribution. The Danish implementation of the digital library is called Biblus, and is available for all visually impaired children and youth in the Danish educational system as well as their teachers and relatives [14]. The digital library has since been implemented in several other countries and institutions as a resource-sharing platform, as an in-house repository of digital media and as member libraries.

Fig. 3. VI Reader – a free e-book reader for people with low vision or dyslexia

In recent years, the introduction of digital books in EPUB and other formats has suggested that the time of cumbersome document conversions may soon be over. The rationale seems to be that once a commercial book is available as an e-book, it can be downloaded to an a-book reader, tablet or computer and read with or without assistive technology. While that may come true sometime in the future, inaccessible e-books,

poor support beyond text and pictures, lacking assistive technology and restrictive copyright enforcement are still major hindrances.

However, around RoboBraille a number of technologies have been developed to explore the possibilities of e-books amongst people with print impairments. VI Reader, a free app for iOS and Android devices illustrated in figure 3 above, can be used to by people with low vision or dyslexia to read digital material in EPUB format. With VI Reader, readers can change the appearance of the contents in terms of scaling, background color, foreground color, contrasts, typefaces, line spacing and reading direction to fit personal preferences and diagnoses. Furthermore, RoboBraille is capable of producing e-books in the most popular formats (EPUB, EPUB3 and MOBI) and can even increase the baseline of body text in the e-books to enable mainstream readers to display commercial e-books and other digital material in large print.

5 Key challenges

Some of the challenges of producing material in alternate formats in a decentralized, mainstreamed environment have been overcome by automating the previous workflows of highly skilled specialists. However, a number of somewhat interrelated issues remain to be addressed.

Of all issues, the competing legislation between the rights to treatment on equal terms on the one side of and the stringent copyright legislation, tough enforcement and unwillingness to collaborate amongst many publishers on the other seems the most damaging. The Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled (MVT)[14] administered by the World Intellectual Property Organization (WIPO) may eventually help resolve some of the issues. However, ratification seems slow and primarily in countries with legislation similar to the proposals in the treaty.

A derived effect on the copyright legislation and enforcement is the increased use of streaming amongst the special libraries. Rather than making digital files available to readers with print impairments, many special libraries are moving towards streaming models where content can only be accessed through special readers or browser plugins. Obviously, this is a problem in a world of alternate media conversion that relies heavily on digital files. Furthermore, streaming services are rarely available for off-line consumption.

A third challenge is the lack of skills amongst those producing digital material. Whereas traditional skilled workers are typically taught how to use tools and materials, so-called knowledge workers are frequently expected to know how to use word processers, PDF converters and similar in a correct and accessible way. Furthermore, few are aware of the principles of digital accessibility and even fewer attempts to comply with these. The result is that the vast majority of all published material is inaccessible to readers with print disabilities. A unpublished survey (2014) by the Danish Ministry of Education of the practices at 13 educational institutions in Denmark revealed that almost all education material produced by the educational institutions failed accessibility criteria and that approx. 80 per cent of the errors were introduced by the authors themselves.

A forth challenge is the lack of skills amongst those converting material into alternate formats on behalf of others. While the requirements of the print impaired remain the same, alternate media producers often have few or no sources to turn to for training. As the general level of proficiency gradually erodes with the disbandment of the special schools and other sheltered environments, chances are that competence levels will continue to dwindle.

5 Conclusions

To some extend it has proved possible to extract key competencies and automate main workflows used to convert material into alternate formats to support those with print disabilities in mainstream environments of education, vocation and elsewhere. Services like RoboBraille can be used by people with very limited skills to automatically convert a significant proportion of material into alternate formats. Availability of material in digital formats, limited IT skills amongst knowledge workers and lack of awareness of the importance of digital accessibility in all types of digital publications, however, are likely to hinder a smooth transition as more countries adopt the route of inclusion. And once segregation with special schools and sheltered employment has been abandoned, the remaining knowledge and practical skills of teaching and supporting those with print impairments are likely to erode unless initiatives are launched to document and preserve knowledge and skills.

In conclusion, alignment of copyright legislation and the rights of equal access should be implemented on a universal scale. Combining technologies such as digital rights management, digital wallets, digital watermarking and digital identification, it should be possible to create systems that protects against proliferation of pirated copies of copyrighted digital material whilst ensuring efficient access to digital documents by those with a need to convert into alternate formats. Mandatory filing of digital copies in proper formats with national libraries of all publications with availability for the print disabled through the special libraries would be a natural development.

Secondly, proper use of authoring technology such as word processors, editors in content management systems and similar should be a mandatory part of any curriculum beyond primary education, ensuring that mainstream technology is used properly and that published documents comply with the basic principle of digital accessibility.

Thirdly, the skills and knowledge in countries that still operate special schools and sheltered vocation should be collected and documented in a way that can be used to train future generations of teachers, educators, careworkers and alternate media professionals on how printed material is adapted to alternative formats to meet the varying needs of readers with print impairments.

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