Exploiting the Daisy format for automated, single-source Braille publishing

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Abstract. This paper presents the background and status of the projects and discusses opportunities and challenges of the AutoBraille/NorBraille approach of using Daisy talking books as the foundation for creating well-formatted, multi-volume Braille books ready for embossing. Whereas the current R&D projects are limited to relatively simple document structures, preliminary research suggests that it will be possible to automatically process even complicated math and science titles.

Keywords: Braille transcription, Daisy, DTB, RoboBraille, single-source publishing, accessibility, visual impairment.

1 Introduction

In an effort to increase availability and quality of Braille material, enable customised Braille productions and reducing the overall cost of producing Braille, Sensus and the National Danish Centre for Visual Impairment for Children and Youth (Synscenter Refsnæs) have worked with the national libraries for the blind in Denmark and Norway to enable fully automated Braille production based on well-structured Daisy books [7]. Using Daisy Talking Books (DTBs) as input, the output are well-formatted, multi-volume Grade 1 and Grade 2 Braille books ready for embossing. Thus far this has resulted in two projects: The AutoBraille project with Danish Library for People with Reading Deficiencies (2008-) and the NorBraille with the Norwegian Library for the Blind (2009-). A similar project will commence in Iceland in 2010 in collaboration with the Icelandic Institute for blind, visually impaired and deaf-blind individuals with the aim of producing books in Icelandic Braille. To a large extend, the work has been inspired by previous work on automated Braille translation, see for example [1], [2], 3], [4] and [5].

The rationale behind the projects is simple: while significant efforts are being invested in scanning, proofing, tagging and validating documents for production of Daisy Talking Books, the resulting source files are rarely used for other purposes. However, documents that have been tagged for DTB production may well contain all the information required for producing material in other alternative formats including Braille, large print and customized formats, making the Daisy format an ideal master format for single-source publishing. In addition to enabling automating production

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workflows, it is anticipated that the reuse of master files for multiple purposes will eventually reduce the cost of individual productions. The concept of single-source publishing is illustrated in Figure 1 below:

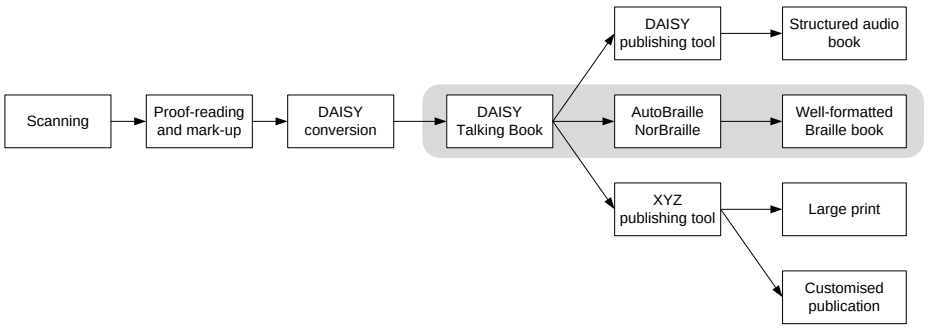

Fig. 1. The concept of single-source publishing to produce material in a variety of alternative formats including Daisy Talking Books, Braille, Large print and customized formats.

The paper presents the background and status of these two projects and discusses opportunities and challenges of the AutoBraille/NorBraille approach, including limitations in terms of the complexity of documents: Whereas the current R&D projects are limited to relatively simple document structures (e.g., TOCs, headings, notes, lists, images, poems), preliminary research suggests that it will soon be possible to automatically process even complicated math and science titles using a combination of 8-dot Braille, LaTeX/MathML, Daisy mark-up, automated Braille translation and AutoBraille/NorBraille.

2 Braille codes and formatting guidelines

Although Braille codes are well-documented and have been used extensively to automatically transform documents into Braille, the formatting specifications are less stringent. In Denmark, no formal layout specification for Braille material appeared to exist; rather, different formatting regimes were implemented at each of the four main production centres. In Norway, a formal layout specification exists but implementation varies across production centres [8] and [9]. Hence, the initial part of each project was to define the how each Daisy tag should be treated in a Braille context.

In general terms, formatting requirements were divided into two overall categories for processing by AutoBraille/NorBraille. The first category covered structural elements from the Daisy specification that are mainly used for formatting and reference purposes, and included major structural elements, block elements, tables and lists. The second category covered inline elements as well as attributes and classes on other elements that directly impacts how the Braille is constructed. These included tags for emphasis, acronyms, abbreviations, anchors, and changes to the natural languages and page numbering scheme. The first category of tags was

implemented in the AutoBraille/NorBraille formatting component, while tags and attributes of the latter were implemented in the SB4 contraction engine. SB4 also forms the foundation for Braille translation in the RoboBraille service, and supports translation between ordinary text and contracted/uncontracted Braille in multiple languages [1], [2] and [3].

Braille readers usually make up a rather conservative group who insists on adhering to standard Braille specifications; however, when the first results of AutoBraille were presented to a representative group of Braille readers, it was decided to implement two different levels of formatting regimes: a rigid regime that formats according to the formal specifications, and a loose regime that formats according to user preferences.

3. NorBraille implementation

Though implemented using different technologies, the AutoBraille and NorBraille share many characteristics. For reasons of simplicity, only the NorBraille project is discussed in dept in this paper. The figure 2 below illustrates the architecture and main components of NorBraille.

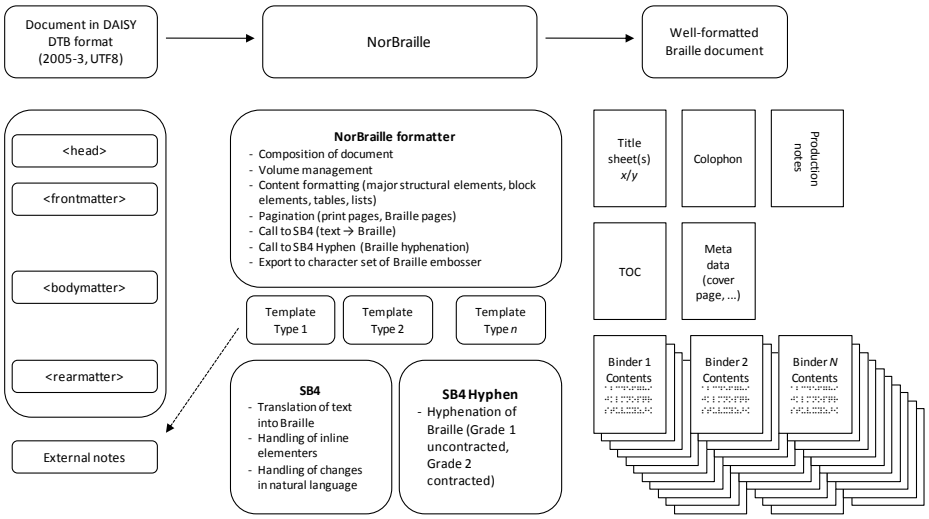

Fig. 2. The NorBraille architecture

As can be seen from Figure 2, a Daisy document (DTB, 2005-3 in UTF8) is passed to NorBraille along with a set of external notes. In effect, the external notes are generated from the list of options in a settings file, and used to generate the production notes presented in the final document.

The solution is comprised by three main components:

1. The NorBraille formatter composes the document based on options in a settings file. As such, the formatter creates the title page (from meta data), the document colophon (from meta data), the production notes (from options settings), table of contents (from structural elements and page numbers), cover page as well as the actual contents of the document. The formatter furthermore divides the documents into one or more binders depending options settings. Also subject to options settings, the formatter paginates the document with print and Braille page numbers. It processes and formats all major structural elements (e.g. headers), block elements, tables and headers. Finally, the formatter is managing calls to the underlying SB4 Braille translation and Hyphenation engines.
2. The SB4 Braille Translation engine translates text to and from Braille according to the specified language, contraction level and process definition. Furthermore, it handles inline elements and changes in the natural language flow according to language-specific definitions.
3. The SB4 Braille Hyphenation engine hyphenates contracted and uncontracted according to language-specific hyphenation rules.

The overall process is managed by a set of parameters defined in a settings file. Hence, a settings file is in effect a document template that specifies how a particular document should be contracted. Available parameters include natural language selection for the source document (e.g., Danish, Norwegian, British English, …), contraction level for the target document, translation process (contract to 8-dot Braille, contract to 6-dot Braille, decontract), formatting settings for headings, blocks, images and other elements, page settings (lines per page, characters per line, margins), pagination settings (pagination, print page numbers, Braille page numbers), volume settings (max and min page count in each volume), options for tables of contents, and a range of embosser settings.

4. Preliminary results

Preliminary tests with NorBraille and a range of DTB documents suggest that it is possible to fully automate the conversion of documents in Daisy DTB format into well-formatted, multi-volume Braille books complete with page numbers, table of contents and layout in accordance with national requirements.

The current implementation is capable of processing a set of basic Daisy tags including <h1>…<h6>, <p>, <blockquote>, <sidebar>, <epigraph>, various classes of tags, <imggroup>, <img>, <caption>, <prodnote>, <note>, <noteref>, <list type=ol>, <list type=ul>, <poem>, and .

Using export filters from the RoboBraille service, it has furthermore been demonstrated that the resulting digital Braille documents can exported from the internal OctoBraille character set of the SB4 Braille translation engine [4] to be embossed on a variety of Braille embossers, including embossers from Index and Braillo.

In terms of speed, processing of book-size documents, including contraction to the selected contraction level, composition, pagination and layout formatting is completed in 20-30 seconds on a standard computer.

5. Future potential

Preliminary results suggest that it will be possible to automate the production of well-formatted Braille documents from source documents in DTB format including a most tag types found in the Daisy specification. Based on the current results of the NorBraille implementation, two additional phases have been proposed, each aimed at exploring the possibilities of extending support for documents containing more complex structures and content. Phase 2, schedules to commence in 2010, is aimed at exploring how it may be possible to process tables with of varying complexity, as well as adding support for preview/post editing capabilities. Furthermore, export capabilities will be extended to support the Portable Embosser Format, PEF [6].

Building on the experiences from the first two phases, phase 3 due to commence in 2011, is planned to explore how documents containing math and other scientific notation may be automatically converted into Braille using LaTeX or MathML in combination with DTB. The phase will furthermore how support for technical drawings and other complicated illustrations may be supported.

6. Conclusions

The current AutoBraille/NorBraille projects have documented that it is possible to produce well-formed, multi-volume Braille documents using the DTB format as the source. Preliminary results furthermore suggest that it will be possible to automate the processing of documents with more complex structures (e.g., tables) and content (e.g., math and scientific notation), thus automating the production of Braille editions of textbooks in a variety of different subjects.

Ultimately, it is suggested that the AutoBraille/NorBraille approach has the potential of significantly increasing availability and quality of Braille material while reducing the cost through reuse.

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