Securing the future of music braille production – the DAISY Music Braille Project

* **Lead author and presenter: Dr. Sarah Morley Wilkins**, Project Manager and User Experience Consultant, UK.
* **Co-author: Arne Kyrkjebø**, Project Lead. Director of Development, Norwegian Library of Talking Books and Braille (NLB), Oslo.
* **Co-author: Haipeng Hu**, Music Braille Technical Consultant. BrailleOrch, China.
* **Project website:** <https://daisy.org/activities/projects/music-braille/>

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# Abstract

This project originated from the shared needs of blindness agencies wanting to secure and future-proof their music braille production services in the face of declining expertise, tools which need further development, and a lack of standards for effective file-sharing. The work was initially funded by the Norwegian Library of Talking Books and Braille (NLB), and the Norwegian Association for the Blind, and since January 2020 is funded by wider sector contributions.

Two international surveys identified the factors involved in supporting blind people with music braille resources for education, employment and leisure, including the production and the teaching and learning of music braille.

Our collaboration will improve the reliability and efficiency of music braille conversion into embossed scores and digital files - by improving existing tools and music braille file format standards, and enhancing opportunities for global file-sharing and professional networking.

The sector agreed that it is currently best to build improvements in existing tools to secure: a robust professional tool(s) for agencies to perform music braille conversion, and an interactive tool(s) for users to create, learn and output music in accessible formats.

We prioritized tool requirements through sector consultation and systematic testing. We now have cycles of phased tool development, testing, and release of improved/new features underway, and resources for professionals are being prepared.

Additionally, we are influencing MusicXML 3.2 and developing guidelines for mainstream music notation engraving to try to improve source files – to get better conversions into music braille.

The project addresses core technical issues, running over 3 years 2020 to end 2022, but related issues including international codes and layouts, and teaching and learning resources also need attention from other organisations.

# 1. Introduction

The DAISY Consortium is delighted to be able to host a collaborative project dedicated to securing the future of music braille production and use.

We recognise that many blind students, amateur and professional musicians, and music teachers will continue to need a braille version of their music scores in hard-copy embossed braille and/or for their refreshable braille display depending on their task and situation. Furthermore, we appreciate that these musicians also need multi-media tools for writing, exploring and outputting musical scores, in addition to braille conversion.

This paper describes the current opportunity we have through this sector-wide collaboration to improve the worldwide availability of music braille, ensuring that more braille music is available to blind musicians worldwide in a simpler and more cost-efficient manner.

We are seeking to:

1. improve the efficiency and reliability of music braille conversion into hard-copy and digital files;
2. improve existing tools and music braille file format standards, and global file-sharing opportunities; and
3. develop and share supporting resources for music braille transcribers worldwide.

The project is led by NLB in Norway with two part-time consultants, supported by a Steering Group **(Ref 1)** of eight industry experts (all DAISY members) who help to make strategic decisions for the benefit of the whole sector.

Our costs are low and efficient, with 75% contributing to tool technical development and 25% contributing to related music braille activities. Sector donations now fund the project, and if you’re able to contribute please contact the lead author.

# 2. The sector’s needs

To explore how widespread concerns were, we investigated the issues which agencies, end-users, teachers and technology developers were facing. We conducted two sector-wide surveys to identify and explore the diverse factors in supporting blind people with music braille resources in education, employment and leisure.

This resulted in a comprehensive sector overview report **(Ref 2)** which determined the project priorities for joint action. The report summarised 23 worldwide responses (17 organisations, and 6 end-users).

We identified four factors which all needed serious attention to secure the future of music braille production and use, fully discussed in the report:

1. the input files need to be as high quality as possible for effective conversion;
2. conversion and mark-up tools need to be accurate and reliable, suitable both for end-users and for agencies;
3. good access to existing intermediary files to reduce duplication of effort;
4. good teaching, learning and promotional resources so blind musicians can study using music in accessible ways including braille.

The sector agreed that it is currently not useful to build brand new tools from scratch as there is vast expertise and potential in existing tools which can be built upon (e.g. HODDER from dzb lesen, GoodFEEL from Dancing Dots, BME from the Italian Library for the Blind). However, the existing tools all need improvements to be fit for the future and to serve international audiences.

A project plan was devised attempting to begin work on each of these areas simultaneously, but with a primary focus on:

1. making improvements to the quality of the input files; and
2. making improvements to the conversion tools.

Further project activities would continue to drive related improvements:

1. influencing the MusicXML standard and future standard MNX through W3C to include tags vital for effective music braille conversion;
2. requesting improvements to mainstream music notation tools, devising engraving standards to give better MusicXML exports for better conversion into music braille, and finding outsource engraving options;
3. supporting the development of metadata for music braille files for effective international file-sharing in global collections; and
4. facilitating a network of music braille transcription specialists to develop resources and support each other.

# 3. Technical requirements for a professional conversion tool

In this part of the project we wish to support the development of a sustainable professional software tool for agency use, enabling rapid and accurate conversion of digital music scores in MusicXML format into music braille scores for embossing or for reading on a braille display. The tool should be capable of converting into several codes and layouts to suit different country requirements.

The tools could already convert scanned ink-print scores into music braille, though the survey identified improvements needed here too, but importing MusicXML files was not yet well-developed. Of course, some music will still need to be converted by hand by music braille transcribers.

First, we created a Requirements Document to capture everything the sector had raised as being necessary in future music braille conversion tools. We devised this from: our survey findings; discussions at Round Table Meetings; trials conducted in the UK of the current tools; and a framework specification devised by Haipeng Hu for a new music braille conversion tool **(Ref 3)**.

We ran a sector consultation to prioritize the features according to needs. We had a representative global response: 34 replies from 15 countries, including organisations and individuals. Many had multiple roles, including transcribers, end-users, teachers and trainers, managers, accessibility specialists, proof-readers, and software engineers.

Each feature was rated as Essential, Desirable, Nice to Have, or Not Needed, grouped into the following categories:

1. Accessibility and Usability
2. File Handling
3. Formatting/Layouts
4. Country Codes
5. Options
6. Conversion of Musical Symbols
7. Output
8. System Requirements
9. Business Arrangements
10. Funding
11. Anything Else.

From responses we created a comprehensive Prioritized Requirements Document **(Ref 4)**. There was an essential need for basic coding and transformations to be accurate and reliable, especially for the most common kinds of musical scores needed (e.g. keyboard, solo instrument, vocal music), and these needed fixing before the implementation of other features.

It became clear that it may be impossible for a single existing tool to cater perfectly for all needs, and that at least two reliable tools would be needed to meet the range of needs across the sector: one for agencies, one for blind musicians.

We invited developers of the existing tools to respond to the prioritized requirements, reporting which features would be easy/complex to build in their product and at what cost **(Ref 5)**. This was the first time they had received collated and prioritized sector requirements and feedback.

# 4. Development of a professional music braille conversion tool

A professional production transcription tool will benefit agencies and educators converting scores into braille for blind musicians. It will allow them to get more scores produced more easily, quickly and accurately through a mostly automated production workflow.

The project chose to work with dzb lesen (The German Center for Accessible Reading) to improve their music braille conversion tool, HODDER, developed over 15 years for their own transcription department, and also used by SBS (Switzerland) and Dedicon (Netherlands).

The conversion engine HODDER already has sophisticated conversion rules for converting scanned ink-print scores from the mainstream scanning and editing tool capella into embossable music braille files.

We agreed a detailed technical workplan for web-based access to HODDER, implementing the prioritized requirements. Our Agile development cycle delivers quarterly improvements in a working tool for immediate benefits, and user testing and feedback is ongoing each quarter.

By the end of 24 months of part-time development, HODDER will offer these benefits:

* An efficient and effective, mainly automated, online professional-quality music braille conversion tool which produces embossed and digital music braille files.
* Effective import and conversion of MusicXML files, with error detection and advice tool.
* Effective import and conversion of scanned paper-based scores through capella.
* Reliable production of Bar-Over-Bar formatting in addition to Section-By-Section, and UEB output, usable in all countries and for education.
* Embossable pages returned as a file, which can also be read directly on a braille display.
* Music braille conversion implemented into agency production workflow via API, to handle music-textbook production.
* Interfaces available in at least 4 languages (including German and English).
* Support documentation available in those same languages.
* Numerous improvements to music notation conversion.
* Simple grouped settings for easy configuration.
* Country/agency option pre-sets can be created and saved.
* Service Level Agreements (SLAs) for agencies, to include the licence for using the tool, set-up advice, and ongoing maintenance and support.
* Purchasable training/consultancy services.
* Limited interactive features for personalizing the score once transcribed.

# 5. Technical requirements for an interactive end-user tool

This kind of tool enables blind musicians themselves to create, read, explore, convert and output music in braille and other accessible ways, e.g. they can hear the score spoken and in musical notes, read it in embossed and digital braille, and output it in braille and ink print.

These tools are particularly valuable when detailed interaction with the score and/or with sighted teachers and peers is essential, and for teachers to quickly convert short pieces for their learners. Existing tools include GoodFEEL and BME, and a tool in development called Sao Mai Braille.

Many of the existing prioritized requirements collected for the professional tool are relevant here, with the addition of some specific requirements for interactive multi-modal features.

A sector consultation was started in January 2020, and the resulting prioritized requirements will be shared with tool developers. They will be asked to respond by June 2020 with which features would be easy/complex to build in their product and at what cost. We then plan to select a tool, secure development funding and agree work to start in January 2021.

We anticipate that an interactive user tool would offer these benefits after 24 months of part-time development:

* An improved accessible and reliable interactive music braille conversion tool for blind musicians and teachers.
* Supports reading, writing, listening, converting and outputting music scores in different accessible ways, including sound, text and braille.
* Numerous improvements to music notation conversion.
* Accurate and automated conversion of musical notation from MusicXML files and scanned paper copies.
* Reliable production of both Bar-Over-Bar and Section-by-Section formats, and UEB output, usable in most countries and for education.
* Simple grouped settings for easy configuration.
* User pre-sets can be created and saved.
* Easy installation (if it’s locally installed).
* Interface translated into at least two additional high-priority languages.
* Documentation and training resources available in the same languages.
* Service Level Agreements (SLAs) for buyers, to include the licence for using the tool, set-up advice, ongoing maintenance and support.
* Purchasable training/consultancy services.

# 6. Improved source file format standards

We will continue to influence digital music standard file formats to increase the numbers of good master files we can use to create good music braille. Sadly, there are many kinds of MusicXML output and they are not always suitable for conversion into music braille, as they often lack sufficient structural detail.

We have already begun to influence the next version of the industry standard file format, MusicXML 3.2 - and its successor in development, MNX - through the W3C Music Notation Community Group. Also, the Italian Library wish to make improvements to their proposed Braille Music Markup Language (BMML).

Subject to available funds, we will deliver:

1. Improvements in MusicXML 3.2 making an immediate difference to the music braille we can create through conversion tools.
2. Our requirements incorporated into the developing MusicXML successor format MNX.
3. Dialogue with developers to exploit opportunities for specific music braille file formats.

# 7. Improved engraving standards in mainstream notation tools

We wish to improve music engraving practice using mainstream notation tools (e.g. Sibelius, Finale, MuseScore) to improve the digital scores available for conversion to music braille. We will continue to give feedback and put pressure on mainstream developers to improve their MusicXML export so the resulting files are structurally more informative for our needs.

We also wish to locate outsourcing options for high-quality engraving of music scores for agencies who cannot locate suitable MusicXML files in online collections, or who cannot scan a print original.

We have prepared engraving guidelines for Sibelius (which currently gives the best native MusicXML export). We are trialling these guidelines with a range of engraving services, and findings already indicate that engravers must follow the guidelines accurately, and carefully proofread their files if they are to be useful to us.

Subject to available funds, we will deliver:

1. Pressure on mainstream music notation tools to improve their MusicXML export.
2. Guidelines for engravers using mainstream music notation tools to generate more useful MusicXML output.
3. A model for outsourcing score engraving so agencies can obtain high-quality MusicXML files.

# 8. Metadata to support effective global file-sharing

We wish to support efforts to incorporate appropriate metadata into music braille files to enable effective global file-sharing and retrieval by agencies and end-users when searching for files in online collections.

It is encouraging that several online collections already include music braille files, or are preparing to add them, and metadata fields are being established. As the quantity of online music braille files increases, the right level of metadata will be needed – and ideally agreed across the sector - to help people to distinguish between similar, but different, versions of the same score, and to find different derivatives of a single source file. If the music braille conversion tools could make metadata insertion as easy/automated as possible that would be advantageous.

Subject to available funds, we will deliver:

1. Trials of metadata for music braille files with global online collections.
2. Proposals for agreed metadata for international adoption.
3. Proposals for music braille conversion tools to add metadata into the music braille files created with their tool.

# 9. An active network testing the tools, sharing expertise and resources

We wish to continue the active communication and joint effort established over two years, supporting the sector in working together as a community of transcribers, developers, teachers and end-users to build capacity.

This is a small niche field, but a vital one for those supporting blind musicians. Providing a forum for networking provides valuable opportunities for reducing duplication of effort and capturing, developing and sharing scarce knowledge. This combined effort will be essential for testing developing tools and giving feedback, and helping to create training and support resources.

Subject to available funds, we will deliver:

1. An active mailing list, and tool-related forums, of interested parties of transcribers, developers, end-users and teachers, sharing information and participation opportunities.
2. Contributions of effort to support working groups sharing their expertise, developing music braille transcription capacity and developing support resources.
3. Further international meetings to share and develop knowledge in particular areas relating to music braille creation, standards and use.

# 10. The future

This niche market is not self-financing, and without an injection of specific financial investment the tools will not be developed sufficiently quickly to meet the needs of agencies, educators and blind musicians for the future.

If our project is fully funded through to December 2022 we anticipate delivering the following benefits for blind musicians, and teachers and agencies supporting them:

1. At least one improved tool for rapid professional, accurate and mostly automated music braille transcription which produces global formats and is linked to a production workflow. Note that this does not remove the need for skilled music braille staff.
2. At least one improved interactive music braille user tool for blind musicians to independently read, write, convert and explore music in accessible ways, in education, for work and leisure.
3. Sustainable tools: technically, and with support resources, service level agreements, and localised versions available.
4. Benefits for DAISY members.
5. Chargeable / low-cost / free tools available for different user groups.
6. Music file format standards (e.g. MusicXML 3.2 and MNX) improved via W3C to include our requirements, generating better conversions through our tools.
7. Music engraving practices are more standardized, with outsourcing options, generating files for better conversions through our tools.
8. More music braille scores are available in online collections with effective metadata for widest global user reach.
9. A network of stakeholders working together on training, support and resources to capture expertise and support each other.

However, there are further developments outside the scope of this project which would also improve the future sustainability of music braille:

1. The use of Artificial intelligence (AI) to improve contextual recognition during both scanning (using Optical Character Recognition, and Optical Music Recognition), import of MusicXML files, and conversion into music braille. Tools which can learn from manual mark-up and conversions would greatly reduce the number of errors and corrections required when importing scores and speed up the conversion process. AI could be integrated into the tools once the project improvements have been implemented.
2. Rationalization of country code and layouts would reduce tool complexity and costs, and permit greater file-sharing. Rule experts checking codes and formatting for each country would be helpful.
3. The provision of high-quality reliable source files in online collections along with their derivative works would increase file-sharing opportunity and speed of production. As more countries implement the Marrakesh Treaty this becomes even more important. The addition of quality digitised back-catalogues of music braille scores would significantly increase the number of available scores.
4. More teaching and learning initiatives are needed to help promote the availability of music resources in all levels of education, for individual users, for trainee teachers, and parents. Resources for new learners and those in integrated school settings are particularly needed, and users would like training opportunities, even online, to improve their knowledge.
5. A reversal in the decline of trained music braille transcribers and music teachers is urgently needed; since even with improved conversion tools, the sector still needs music braille experts to teach and train, to proofread and set standards, and continue to help test and shape the tools in the future. Furthermore, some scores cannot yet be converted automatically, so manual transcription is still necessary.
6. Trials will be needed on new refreshable braille displays with the different formats generated by the music braille tools, and feedback given to the developers of the conversion tools and the braille displays.
7. Ongoing international collaboration via formal or informal means to maintain knowledge transfer and development. SBS in Switzerland has proposed a Virtual Global Competence Centre **(Ref 6)** for music braille experts which could be one way to build capacity in this niche sector.

# References

[web links working as of 24 February 2020]

**Ref 1:** Project Steering Group

<https://dl.daisy.org/projects/musicbraille/Steering_Group_Announcement_30-09-19.docx>

**Ref 2:** “Music Braille Production in 2018” a Phase 2 Research Report from the DAISY Music Braille Project (31.07.2018).

<https://dl.daisy.org/projects/DAISY_Music_Braille_Research_Report_Phase2-FINAL.docx>

**Ref 3:** BrailleOrch (Haipeng Hu’s framework specification and file collection)

<http://www.brailleorch.org/en/>

**Ref 4:** “Findings from the DAISY Music Braille Conversion Tool Requirements Survey” - the Prioritized Requirements Document (15.04.2019)

<https://dl.daisy.org/Findings_from_the_DAISY_Music_Braille_Conversion_Tool_Requirements_Survey_15.4.2019.docx>

**Ref 5:** Notes of Geneva Meeting May 2019, including developer responses/presentations to Requirements: [https://dl.daisy.org/Notes\_&\_Presentations\_Geneva\_DAISY\_Music\_Braille\_Meeting\_28-29\_May\_2019.zip](https://dl.daisy.org/Notes_%26_Presentations_Geneva_DAISY_Music_Braille_Meeting_28-29_May_2019.zip)

**Ref 6:** SBS proposal for virtual global competence centre

<https://dl.daisy.org/SBS_Questionnaire_and_Presentation.zip>