**Development of A Sheet Music Organisation System**

**Initial Report**

Submitted for the BSc in Computer Science with Industrial Experience

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by

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# 1. Introduction

Notation of western music has used a combination of the diastematic and phonetic notation, (Richard Rastall, 1983) since the advent of Gregorian chant, around 640 AD (Jim Paterson, 1999). This system involves sounds being represented graphically, upon convention of high and low in the vertical plane, and duration moving from left to right horizontally. The representations of other parameters in staff notation are normally phonetic, such as indications p (piano), pizz (pizzicato), (Richard Rastall,1983) and other stylistic features.

This report intends to detail the chosen project, the development of a sheet music organisation system which aims to solve the problem of organisation of large sections of sheet music, and will provide background, aims and objectives of the project as well as a more detailed task list and time plan, followed by an analysis of any risks of the project development.

## 2. Background

With the aid of computers, music has taken a sudden evolutionary jump and many musicians have stumbled at the fence. (Hammond, 1981) Unlike previous eras, composing music is now a simpler process due to the use of software such as Sibelius, which enables you to express, accelerate, and promote your creativity in more ways than ever before (avid.com, 2014). Sibelius is the most widely used commercial composition software, which provides most of the features required of a musical editing software, from the basics of changing pitch and note duration to automatic transposition and playback, but at a premium rate.

An alternative, MuseScore, is open source and provides much of the same functionality.

Whilst these solutions allow the composer to compose and edit music, there are very few solutions which provide automatic organisation, which means that whilst music is created in this way, it is often still catalogued offline using paper printouts or books which are catalogued by one sorting rule only, usually instrument, style or composer.

The usage of paper storage makes it difficult, for example, for conductors and musical directors of large wind bands and orchestras with a variety of instruments to find suitable scores which have parts for every instrument, singers who need a piece for a specific voice and a specific key in order to fit in their vocal range, and arrangers to find pieces to merge together which will have suitable keys to blend.

Further to composition, sharing has become easier with the integration of social media options to both suggested pieces of software, but neither provide a spotify-like interface in-program for browsing this data. Similarly to the problem of having a large collection of music and not being able to peruse it easily, a program which provides functionality more easily than using a search engine for finding publicly available sheet music would be advantageous to musicians needing a very specific repertoire.

There are various platforms and projects, such as the International Music Score Library Project, which was built with the intention of sharing the world’s public domain music, a platform which contains 290,000 scores to date (imslp.org, 2014), all of which are free. This provides a potential data source for building such a platform for sharing. This would be a useful feature in this project, though implementing any of the libraries could prove challenging depending on the API availability.

Two further potential additions would be conversion from sheet music to MIDI, as for classical musicians working towards graded exams, finding a rehearsal track for much of the material is a difficult proceedure, and usually incurs fees for purchasing recordings. Given that the musician would have the accompaniment part with the piece itself, it should be possible for a program to generate tsound output easily based on an inputted MusicXML file.

The second extra would be conversion from a flat image to MusicXML using OCR, as this would speed up the input of sheet music and enable a physical library of music to be merged with the user's electronic collection with ease.

# 3. Aim and Objectives

## 3.1 Overall Aim

The overall aim of the project is to design and develop a sheet music library application, with the ability to organise, view and save sheet music. Time permitting, It should also be able to generate sound from the sheet music, import online resources, and import editable music from flat images.

## 3.2 Primary Objectives

The main objectives for this project will be defined by the following abilities of the program:

1. Rendering a musicXML file
2. Automatic extraction metadata about the music to organise it in the program
3. Import music from open, online libraries such as the IMSLP (International Music Score Library Project)

### Objective 1 – rendering a musicXML file

In order to create a working library application, it is vital that the file format is rendered properly. The developer has chosen musicXML as this is a standardised format and used by many other composition programs, therefore should have the most availability for test cases. It will also be easier to process and serialise to objects by the program, and save out using existing XML libraries.

### Objective 2 – extraction of metadata

The extraction of metadata will involve having a folder of imported files for the program to read, and using XML parsing extract details such as title, composer and instrumentation, in order for the user to be able to peruse music pertaining to the area of interest they have. This relates to the aim as manual organisation for a large collection of scores, particularly orchestral scores, will take a longer period of time and be tedious to handle.

### Objective 3 – import music from online libraries

Whilst it is of course possible to view libraries such as the IMSLP and other open score libraries through a web browser, it would be useful to have a part of the program be able to handle this process automatically or have a built in browser for these libraries. This however poses copyright issues if the program were to import from search engines such as Google, so the IMSLP, for which all copyright has expired, would be the main testcase for this feature.

## 3.3 Secondary Objectives

Given the nature of the task and the time constraints, these objectives will be implemented if the above objectives are met:

1. Conversion from musicXML to playable MIDI/mp3 files
2. Ability to scan hard copies of sheet music into musicXML format using OCR methods

### Objective 1 – musicXML to playable MIDI/mp3

It would be useful to convert the files stored from music XML to playable midi/mp3, which is a feature of most composition packages, not only in order to test any changes sound correctly, but also for automatic generation of accompaniment practice parts for auditions and graded examinations. Due to this being a potentially challenging objective, this is a secondary objective.

### Objective 2 – ability to convert from scanned music to musicXML

This is potentially the most challenging objective, but a third and final extra feature which would be useful to musicians would be the ability to scan music, as many musicians have a large collection of offline printed works, and have this automatically converted to renderable, editable musicXML. This relates to the main aim as the project is to create a music library, so being able to merge online libraries with offline libraries would be a useful ability.

# Task List

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Task Name** | **Description** | **Duration**  **(days)** |
| 1 | Initial report | Write initial report deliverable | 3 |
| 2 | Testcase | Create or find a good testcase for musicXML rendering | 0.1 |
| 3 | Research testcase rendering | Research best method for rendering musicXML simply | 3 |
| 4 | rendering | Implement rendering | 4 |
| 5 | Objects | Load musicXML into objects | 4 |
| 6 | Design a user interface | Design a user interface on paper | 2 |
| 7 | Gather feedback | Gather feedback on whether user interface is simple to use for other musicians | 2 |
| 8 | Implement user interface | Create user interface in chosen programming language | 2 |
| 9 | Render testcase in user interface | Render the music inside the portion of the interface used for rendering | 3 |
| 10 | Interim report | Write interim report deliverable | 4 |
| 11 | Implement user interface callbacks | Connect callbacks for each button to the function they should do to the music | 4 |
| 12 | Extract metadata to a text file | Parse musicXML file for instrument, composer, year and title and output to a text file. Apply this to multiple musicXML files | 2 |
| 13 | Commandline search | Create a commandline interface for searching for all titles containing particular elements: e.g -instrument clarinet | 3 |
| 14 | Implement search in GUI | Implement the same searching functionality in the gui: initially using the same syntax, then using more complex search methods which exclude “-instrument” | 5 |
| 15 | Research IMSLP | Research storage of data on IMSLP, whether they have an API and if possible contact the organisers about any possibility of its existence | 3 |
| 16 | Create metadata listing for IMSLP data | Extract from files on IMSLP same metadata as for a person's own library | 3 |
| 17 | Include data from IMSLP in search functionality | Extend the search option to include metadata from IMSLP | 2 |
| 18 | Add import option to files not existing on system | Add a way to download the files from IMSLP or other source when they come up in the search option | 3 |
| 19 | Research MIDI conversion | Research how MIDI files are created, and how other packages create MIDI files | 5 |
| 20 | Create conversion from musicXML to MIDI | Convert musicXML to midi potentially without using the GUI, or from the objects in the GUI depending on research | 2 |
| 21 | Research MusicOCR | Examine opensource options and libraries for OCR and consider whether it would be a doable feature | 7 |
| 22 | Implement OCR | Implement research if there is time | 7 |
| 23 | Final report | Write final report deliverable | 14 |

# Time Plan

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **University Calendar Weeks** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **#** | **Task Name** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Interim report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | D |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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# Risk Analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Risk** | **Severity**  **(L/M/H)** | **Likelihood**  **(L/M/H)** | **Significance (Sev. x Like.)** | **How to Avoid** | **How to Recover** |
| Data loss | H | M | HM | Keep Backups | Reinstate from backups |
| Loss of backups | H | L | HL | Multiple Backups | Use alternate |
| Lack of time | H | H | HH | Stick to timeplan | Remove secondary objectives |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

# References

Parker, D., 2013. *Referencing with Word.* [Online]   
Available at: http://intra.net.dcs.hull.ac.uk/student/modules/08341/WebPages/ReferencingWithWord.html  
[Accessed 18 September 2014].

University of Hull Skills Team, 2014. *What is referencing and how do you do it?.* [Online]   
Available at: http://www2.hull.ac.uk/lli/skills-development/referencing/introduction\_to\_referencing.aspx  
[Accessed 19 September 2014].

# Appendices

## Appendix A – Each appendix should have a title

# Ethics Checklist for Student Projects

If your project uses other people (‘participants’) for the collection of information (typically in getting comments about a system or a system design, getting information about how a system could be used, or evaluating a working system) then you need to read through the checklist in Section A below before completing the declaration in Section B.

If your project does **not** make use of other people then you can skip Section A and directly complete the declaration in Section B by marking box ‘1’ with an X.

Section A

**1. Participants will not be exposed to any risks greater than those encountered in their normal working life.**

Researchers have a responsibility to protect participants from physical and mental harm during the investigation. The risk of harm must be no greater than in ordinary life. Areas of potential risk that require ethical approval include, but are not limited to, investigations that occur outside usual laboratory areas, or that require participant mobility (e.g. walking, running, use of public transport), unusual or repetitive activity or movement, that use sensory deprivation (e.g. ear plugs or blindfolds), bright or flashing lights, loud or disorienting noises, smell, taste, vibration, or force feedback

**2. The experimental materials will be paper-based, or comprised software running on standard hardware.**

*Participants should not be exposed to any risks associated with the use of non-standard equipment: anything other than pen-and-paper, standard PCs, mobile phones, and PDAs is considered non-standard.*

**3. All participants will explicitly state that they agree to take part, and that their data could be used in the project.**

*If the results of the evaluation are likely to be used beyond the term of the project (for example, the software is to be deployed, or the data is to be published), then signed consent is necessary. A separate consent form should be signed by each participant.*

*Otherwise, verbal consent is sufficient, and should be explicitly requested in the introductory script.*

**4. No incentives will be offered to the participants.**

*The payment of participants must not be used to induce them to risk harm beyond that which they risk without payment in their normal lifestyle.*

**5. No information about the evaluation or materials will intentionally be withheld from the participants.**

*Withholding information or misleading participants is unacceptable if participants are likely to object or show unease when debriefed.*

**6. No participant will be under the age of 16.**

*Parental consent is required for participants under the age of 16.*

**7. No participant will have an impairment that may limit their understanding or communication.**

*Additional consent is required for participants with impairments.*

**8. Neither I nor my supervisor is in a position of authority or influence over any of the participants.**

*A position of authority or influence over any participant must not be allowed to pressurise participants to take part in, or remain in, any experiment.*

**9. All participants will be informed that they can withdraw at any time.**

*All participants have the right to withdraw at any time during the investigation. They should be told this in the introductory script.*

**10. All participants will be informed of my contact details.**

*All participants must be able to contact the investigator after the investigation. They should be given the details of both student and module coordinator or supervisor as part of the debriefing.*

**11. The evaluation will be discussed with all the participants at the end of the session, and all participants will have the opportunity to ask questions.**

*The student must provide the participants with sufficient information in the debriefing to enable them to understand the nature of the investigation.*

**12. All the data collected from the participants will be stored in an anonymous form.**

*All participant data (hard-copy and soft-copy) should be stored securely, and in anonymous form.*

If your evaluation does comply with all the twelve points above, please mark box ‘2’ in Section B.

If your evaluation does not comply with one or more of the twelve points above, please mark box ‘3’ in Section B unless you **know** that your supervisor already has ethical approval for the project (in which case mark box ‘4’). If you are unsure mark box ‘3’.

*[adapted from Department of Computing Science University of Glasgow Ethics checklist form for 3rd/4th/5th year, MSc IT/CS/ACS projects 2007]*

Section B

|  |  |  |
| --- | --- | --- |
| This is a declaration that the ethical concerns for above project have been considered (in particular with regards to the 12 point checklist above) with the following outcome: | | Please mark only ONE box with an X |
| 1 | This project does not involve other people in the collection of information and therefore does not require an ethical review | X |
| 2 | This project complies with the **entire** twelve point ethical checklist and therefore does not require ethical review. |  |
| 3 | This project does not comply with **all** of the twelve points above and therefore does require ethical review and the completion and submission of an ethical approval form. |  |
| 4 | This project does not comply with **all** of the twelve points above, however the supervisor already has ethical approval for this research |  |

If you have marked box ‘3’ you will be expected to apply for ethical approval. Further advice is available from both your project supervisor and the Department’s Ethical Officer, as well as by reading and completing the necessary forms contained in the Department’s Guidelines for Ethical Procedures; available online at:

[http://intra.net.dcs.hull.ac.uk/sites/home/staff/ethics/Ethics%20Committee/Forms/AllItems.aspx](http://intra.net.dcs.hull.ac.uk/sites/home/staff/ethics/Ethics Committee/Forms/AllItems.aspx)