IIIF-based lyric and neume editor for square-notation manuscripts

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Abstract

In this paper we introduce a set of improvements to Neon, an online square-notation music editor based on the International Image Interoperability Framework (IIIF) and the Music Encoding Initiative (MEI) file format. The enhancements extend the functionality of Neon to the editing of lyrics and single-session editing of entire manuscripts and lyric editing. We describe a scheme for managing and processing the information necessary for visualizing and editing full manuscripts. A method of concurrently editing the position and content of lyrics is also discussed. We expect these will provide a better user experience when correcting the output of automated optical music recognition workflows.

Introduction

Neon is a web-based music editor for square notation designed for correcting the output of optical music recognition (OMR) workflows [1]. The project went through many iterations since its original release and currently uses MEI (Music Encoding Initiative) and Verovio[1] as its underlying format and technology [2]. In this paper, we present the latest advances in the application. The main improvements are: (i) the use of the International Image Interoperability Framework (IIIF)[2] to source the images and (ii) the ability to display and edit text in the page. Also, we propose a method of relating IIIF Manifests to MEI files.

These refinements to Neon are motivated by actual musical needs. Using IIIF allows users to view the entire manuscript, as opposed to the previous page-by-page editing approach of Neon, which lacked surrounding context. Being able to edit text is crucial for chant in square notation because, like all neume notations, the music is composed to be sung. As a result there is a direct mapping between the neumes and syllables. Since the MEI Neume module is capable of expressing the link between these elements in a hierarchical fashion [3], we can visualize and edit text effectively using MEI.

Section 1

Section 1.1

Musical works are best described in their original sources. For square-notation music these are manuscripts. High-quality images are necessary for processes like OMR, which rely on computers to create digital encodings, but are also necessary for human editors that cannot physically access the original source. Using images presents its own problems; an image representing a page can be well over 100 MB and ordering these images requires additional information. These characteristics result in a large payload to transfer for even one image where much of it is unused as humans need less detail to recognize musical elements than computers.

1 https://www.verovio.org/

2 https://iiif.io/

IIIF addresses this problem through its Image API (Application Programming Interface). It allows parts of an image to be requested at various sizes [4]. These sizes permit a IIIF viewer to request images of varying levels of detail based on how much a user zooms in. This can reduce download times for images while maintaining a consistent quality of user experience. The IIIF Presentation API provides information about the overall document including page order.

We integrated Diva.js into Neon to display entire manuscripts with square notation. Diva.js[3] is a IIIF-compliant document viewer written in JavaScript [5]. It is particularly suited for the purposes of viewing and scrolling through large manuscripts as it loads parts of images as needed. A metadata file discussed in the next section is used to associate MEI documents to their corresponding pages. After each document is associated with its corresponding image, it can be rendered and overlaid on the source page displayed by Diva.js.

Section 1.2

One significant challenge in manuscript viewing and correction is the mapping of the MEI encoding the musical content of a page to the image source for that page. This mapping must be determined quickly to reduce loading time and be usable with multiple sets of MEI files. Three approaches were considered to create these mappings: in the MEI files, in the IIIF Presentation Manifest, or in an additional metadata document. Ultimately the metadata document method was selected.

The source description field of an MEI document can include information about the source image used to produce the encoding. Determining which MEI document corresponds to which page is trivial. However this approach requires all MEI documents to be loaded and processed before any data can be conveyed, adding latency to the correction or viewing process.

The IIIF Presentation Manifest provides a means of adding annotations to documents that could be used to associate an MEI document to its corresponding image [4]. Since this information is provided in a document that must be downloaded for a viewer anyway, the additional loading time is minimal. However, the IIIF Manifest can only be changed by the organization hosting it and restricts the ability of people to add new sets of MEI files to a source or change existing files in any way that would require changes to the manifest.

Using a separate metadata file for these associations proved to be the most suitable approach. This method forms a “Neon Manifest”[4] containing the IIIF Manifest, defining the source and its pages, and annotations between MEI documents and their corresponding pages. These annotations are stored as a JSON-LD[5] file. Different metadata files can exist to represent the results of different OMR processes or different editors.

The implementation of this separate manifest provides an efficient way to use a IIIF viewer such as Diva.js in an editor for square-notation manuscripts.

Section 2

As almost all square-notation music contains lyrics, a lack of support for viewing or editing that information makes a square-notation editor incomplete. Since Neon operates as part of OMR, an ability to interact with both the text itself as well as its location on a page is essential. With lyric alignment approaches now being available for OMR [6] it is possible to include text and position information about lyrics in MEI.

There are two main considerations for syllable text editing: how to encode it in MEI and how to display the information to the user. In the MEI 4.0 Neume Schema, text is segmented syllable-by-syllable. The text for each syllable is included in the <syl> element, which is part of a <syllable> element that also contains the neumes. A <zone> element associated with the <syl> element describes where the text would appear in the page. This facsimile information is already used to encode the layout of other musical elements in Neon. Neume editing can result in the neumes being grouped into one <syllable> element from many or split into many <syllable> elements from one. In these cases the text and location information of <syl> elements must be modified as well to reflect these changes in the encoding and permit manual editing.

3 https://ddmal.music.mcgill.ca/diva.js/

4 https://github.com/DDMAL/Neon/wiki/Neon-Manifest

5 https://json-ld.org/

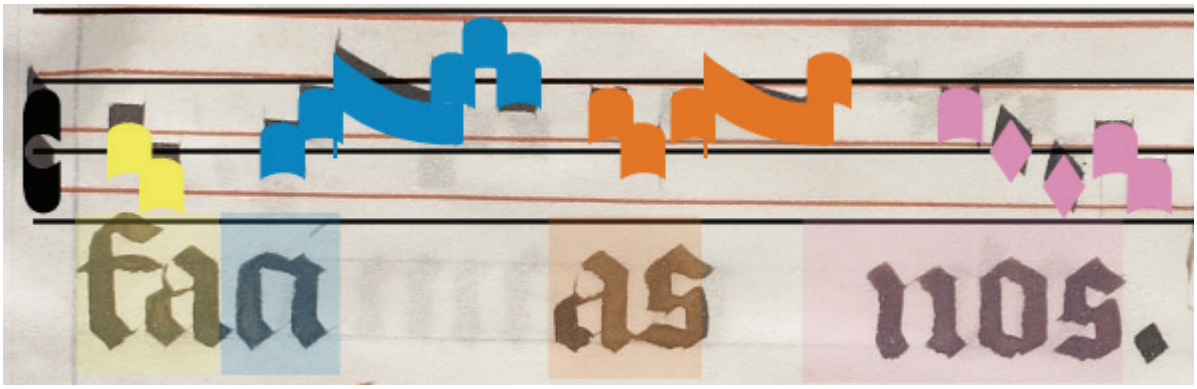

Figure 1: Figure 1: An example of lyric bounding boxes being visualized in Neon. Each syllable, including both neumes and text, is highlighted in a different color. If correction of the linking between syllables and neumes is needed, Neon provides a functionality to perform this mapping.

Since <syl> elements must exist in a syllable and using multiple <syl> elements per syllable is redundant, it is guaranteed in Neon that each <syllable> element will have exactly one <syl> child.

li i ho mi num si mul in u num di ves et pau per i te qui re gis is ra el in ten de qui de du cis ve lut o vem io seph qui se des su per che lut ru bin nun ci a ex ci ta do ne po ten ti am tuam et ve ni ut sal vos fa ci as nos qui reg na tu rus ci e bam in vi su no ctis et ec ce in nu bi bus ce li fi li us ho mi nis ve nit et da ce tum est e i reg om e

Figure 2: Figure 2: The text content of a page displayed in Neon. The syllables shown in Figure 1 are contained in a red box.

To facilitate editing of neumes, the source image is overlaid with the Verovio rendering of musical symbols. With lyrics, this method does not provide similar benefits, because the appearance of letters vary from source to source and spacing between letters is inconsistent even within a page. Neon displays the text in a separate window beside the image. Partially-transparent bounding boxes are overlaid as shown in Figure 1 while the text of each syllable is displayed as in Figure 2. The bounding box corresponds to the information in the <zone> element associated with the <syl> element.

Conclusion

Square-notation music was written in multi-page manuscripts and represent pitches that are sung with lyrics. Support for multiple pages is provided using a IIIF Manifest file to supply information about the source images. With a separate manifest file relating specific MEI documents to manuscript pages, Diva.js is used to render the MEI over source images across multiple pages. Lyric visualizing and editing features are added. These convey the position and context of text in MEI and permit the user to edit lyrics while concurrently correcting neumes. The implications of editing neumes in MEI on lyrics are considered and resolved in the new version of Neon. Together, these features provide a more complete user experience.

Works cited

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