# A WEB-BASED INTERFACE FOR SCORE FOLLOWING AND TRACK SWITCHING IN CHORAL MUSIC

**Frank Zalkow**[1]     **Sebastian Rosenzweig**[1]     **Johannes Graulich**[2]
**Lukas Dietz**[1]     **El Mehdi Lemnaouar**[1]     **Meinard Müller**[1]

[1] International Audio Laboratories Erlangen
[2] Carus-Verlag GmbH & Co KG

{frank.zalkow, sebastian.rosenzweig, meinard.mueller}@audiolabs-erlangen.de
jgraulich@carus-verlag.com

## ABSTRACT

Music can be represented in many different ways. In particular, audio and sheet music renditions are of high importance in Western classical music. For choral music, a sheet music representation typically consists of several parts (for the individual singing voice sections) and possibly an accompaniment. Within a choir rehearsal scenario, there are various tasks that can be supported by techniques developed in music information retrieval (MIR). For example, it may be helpful for a singer if both, audio and sheet music modalities, are present synchronously—a well-known task that is known as score following. Furthermore, listening to individual parts of choral music can be very instructive for practicing. The listening experience can be enhanced by switching between the audio tracks of a suitable multi-track recording. In this contribution, we introduce a web-based interface that integrates score-following and track-switching functionalities, build upon already existing web technology. For an illustration we refer to Figure 1.

## 1. CHORAL MUSIC

Choral music is an important part of our musical culture. Most choral singers practice their parts with traditional material, such as printed sheet music and CD recordings. Integration of new interfaces could enhance the rehearsal experience of many choral singers. In the last years, traditional music publishers have started to make use of MIR technology for their products. For example, the Carus publishing house—a leading publisher of sacred and secular choral music worldwide—has developed an application called *carus music, the choir app*[1] , which integrates score-following and voice-enhancement functional-

---

[1] https://www.carus-verlag.com/en/digital-media/carus-music-the-choir-app/

| ID | Title | Parts | Dur. |
|---|---|---|---|
| 044 | Abends, will ich schafen gehn | SA | 02:45 |
| 056 | Der Ring | SS | 01:15 |
| 079 | Schwesterlein, wann gehn wir nach Haus | SAA | 02:52 |
| 081 | Un poquito cantas | SSA | 01:29 |
| 105 | Greensleeves | SSA | 04:18 |

**Table 1**. Overview of the *Chorissimo! blue* subset. Durations (in format mm:ss) relate to the recordings of Carus' in-house recording label.

ities. For many musical works, Carus offers sheet music as well as music recordings. One such example the multimedia package *Chorissimo! blue* [8], which is aimed at teaching music at the secondary school level. The choir book (along with reference recordings) offers a comprehensive and stylistically diverse repertoire of one-, two- and three-part songs.

## 2. INTERFACE

In a recent collaboration with Carus, we explore the potential of MIR technology in a choir rehearsal scenario. As a first step, we consider selected pieces of *Chorissimo! blue*. Aside from the sheet music and the recordings of Carus' in-house recording label, we also have access to multi-track recordings for all parts. See Table 1 for an overview of our subset. Our web-based interface can be accessed via the following link:

```
https://www.audiolabs-erlangen.de/
resources/MIR/2018-ISMIR-LBD-Carus
```

The demonstrator combines score-following and track-switching functionalities. As illustrated in Figure 1, the current audio playback position is synchronized with the currently highlighted measure (pink box). Furthermore, in Figure 1 a track with enhanced alto voice is selected, which leads to colored notes in the alto part of the sheet music. We plan to integrate and demonstrate further MIR technologies to explore their potential to support singers with effective choir rehearsal preparation. This includes intonation analysis, which is of interest for choir singers and is also a field of general interest for the MIR community [1, 2].
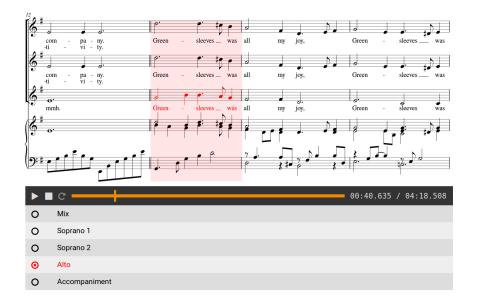
**Figure 1**. Screenshot of the interactive choral music interface, showing the song *Greensleeves* with the alto part being highlighted.

Web-based interfaces, using score following and other MIR technologies, have been applied in several related areas, e.g. performance analysis [3, 4, 7]. A related data set is the *Choral Singing Dataset*, which was published recently [1].

## 3. TECHNICAL REALIZATION

Given our multi-track recordings, we are able to seamlessly switch between the tracks with the audio player *trackswitch.js* [9]. The sheet music (given as MEI file) is dynamically rendered in the web browser with the help of *Verovio* [6]. Music-synchronization techniques [5] (symbolic–audio) or manual annotations provide information about measure boundary positions. Such annotations open up the possibility of highlighting measures in the sheet music that correspond to the current audio playback position, see Figure 1. The currently selected choral part is reflected by playing the corresponding track and by coloring notes that correspond to this part. Furthermore, the specific currently played notes can by highlighted by interpolating the measure boundary positions with respect to the note durations, as specified by the sheet music.

Seen individually, these technologies are not novel, but in this contribution, we combine score-following and track-switching functionalities, which can be beneficial in a choir rehearsal context. The simple implementation with standard web-based techniques lay a foundation for a flexible framework that can be easily expanded, to explore the potential of MIR technologies for such a scenario.

## 4. ACKNOWLEDGMENTS

## 5. REFERENCES

[1] Helena Cuesta, Emilia Gómez, Agustín Martorell, and Felipe Loáiciga. Analysis of intonation in unison choir singing. In *Proc. of the Int. Conf. on Music Perception and Cognition (ICMPC)*, Graz, Austria, 2018.

[2] Jiajie Dai and Simon Dixon. Analysis of interactive intonation in unaccompanied SATB ensembles. In *Proc. of the Int. Society for Music Information Retrieval Conf. (ISMIR)*, pages 599–605, Suzhou, China, 2017.

[3] Martin Gasser, Andreas Arzt, Thassilo Gadermaier, Maarten Grachten, and Gerhard Widmer. Classical music on the web – user interfaces and data representations. In *Proc. of the Int. Conf. on Music Information Retrieval (ISMIR)*, pages 571–577, Málaga, Spain, 2015.

[4] Dasaem Jeong, Taegyun Kwon, Chaelin Park, and Juhan Nam. PerformScore: Toward performance visualization with the score on the web browser. In *Demos and Late Breaking News of the Int. Society for Music Information Retrieval Conf. (ISMIR)*, Suzhou, China, 2017.

[5] Meinard Müller. *Fundamentals of Music Processing*. Springer Verlag, 2015.

[6] Laurent Pugin, Rodolfo Zitellini, and Perry Roland. Verovio: A library for engraving mei music notation into SVG. In *Proc. of the Int. Society for Music Information Retrieval Conf. (ISMIR)*, pages 107–112, Taipei, Taiwan, 2014.

[7] Daniel Röwenstrunk, Thomas Prätzlich, Thomas Betzwieser, Meinard Müller, Gerd Szwillus, and Joachim Veit. Das Gesamtkunstwerk Oper aus Datensicht – Aspekte des Umgangs mit einer heterogenen Datenlage im BMBF-Projekt "Freischütz Digital". *Datenbank-Spektrum*, 15(1):65–72, 2015.

[8] Klaus Konrad Weigele and Klaus Brecht, editors. *Chorissimo! blue. Chorbuch für die Schule*. Carus, Stuttgart, Germany, 2016.

[9] Nils Werner, Stefan Balke, Fabian-Robert Stöter, Meinard Müller, and Bernd Edler. trackswitch.js: A versatile web-based audio player for presenting scientific results. In *Proc. of the Web Audio Conf. (WAC)*, London, UK, 2017.