Score and sound-based interface for exploring music performances

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Aims/goals

Musical interpretations and timbre can be examined using sound analysis. Such interfaces provide possibilities for spectrographic analysis and manual annotation. However, in order to present the results of the musical analysis gained by such an approach, it is often necessary to refer to the musical score. Currently used interfaces could benefit from including synchronized scores, ideally the scores used in the recording with hand-written annotations, markings and scribbles by the performer.

Background information

Current sound analysis applications do not have support for music scores. Sonic visualiser (Cannam 2010) is one of the most advanced such tools. It offers various possibilities for spectral analysis and plugins can provide additional audio analysis methods. Annotation layers can be used to mark time instances, to show images or annotate text. But the musical score, which is often the basis for the performers' interpretation, remains absent. On the other side, audio-to-score alignment applications, such as Prätzlich et al.'s (2015) FreiDi:syncPlayer, have not been taken into account as visual analytics tools to interface music performances and visualize the relation of score annotations and recorded audio. With our tool MuPEx (Music Performance Explorer) we present a first attempt to introducing scores to such analysis contexts.

Methodology

The synchronization of scores with audio recordings requires a common data basis for both representations. Data formats such as MIDI and MusicXML are often utilized as an intermediate link between these two modalities but lack the ability of representing actual images and image annotations. We therefore opted for MEI, a file format primarily used to describe musical notation and the underlying graphical layout. The actual alignment of audio and MEI was done using dynamic time warping with chroma features (Müller 2007). In order to link back to the scans of original scores used by the performers, we developed Vertaktoid, an Android app that lets the user annotate measures in a score (Mexin et al. 2017). This allows us to link from an aligned audio via the MEI measure ID to pixel coordinates in the original scores.

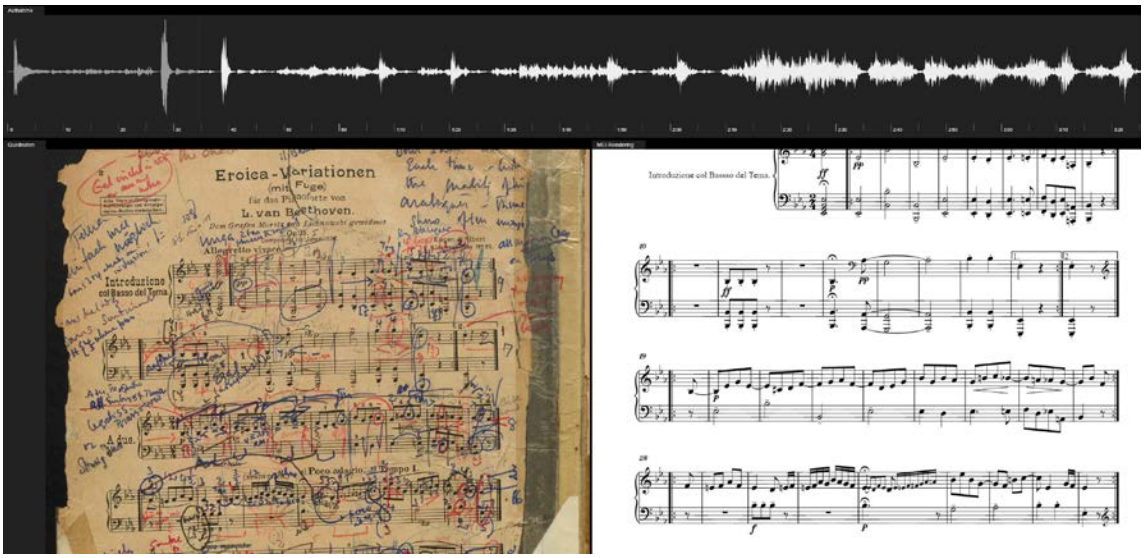

Fig. 1: The MuPEx interface with three different sources (audio, scan and score rendering).

Results

We developed a web-based interface (see fig. 1) that combines music recordings with their corresponding score. By calculating the alignment between audio files, scans of the scores used during production and clean renderings of the scores, the interface allows for transmedial navigation and annotation. Clicking in either one of the three views moves the playback cursor in all other views to the corresponding positions. Annotations can therefore be made in the view that has the strongest relation to its content, e.g., timbre-related annotations can be made directly in the waveform while the (written) reason for the specific change in timbre is highlighted in the scan.

Conclusions

The development of MuPEx was motivated by musicologists in the field of performance research who were struggling for a long time with a media break between scores, audio recordings and audio analysis visualizations. Audio-to-score alignment marks the first step towards a more comprehensive conflation of various music representation modalities, each providing a different perspective to the music. Beyond score and waveform visualization we consider several future additions, including frequency and phase spectro- grams, video integration, and plottings of results from third-party analysis tools such as Sonic Visualizer.

Potential application scenarios of MuPEx are not limited to performance research where it enables a visual analytics-based methodology that is new to this field. We see further interesting applications also in music teaching and as part of digital music editions.

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