



# Multimodal Music Recording Remastering

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## Objectives

My proposal for this Ph.D. is to develop methods for a **user-centered** remastering of **music performance** recordings for giving the user an **interactive multimedia experience**. The idea is to guide audio **source separation/enhancement** using the user's attention as a high-level control/feedback to select which, for him/her, is the desired source to enhance. In the case of music performances, the source to enhance is represented by a particular **instrument** in the ensemble, thus we have a **polyphonic music** source separation problem.

## Audio Source Separation

**Source separation** refers to *extracting one or more target sources in a mixture while suppressing interfering sources and noise, excluding dereverberation and echo cancellation* [10].

When talking about music...

- *mixture*  $\Rightarrow$  **polyphonic music**
- *target sources*  $\Rightarrow$  **individual instruments**

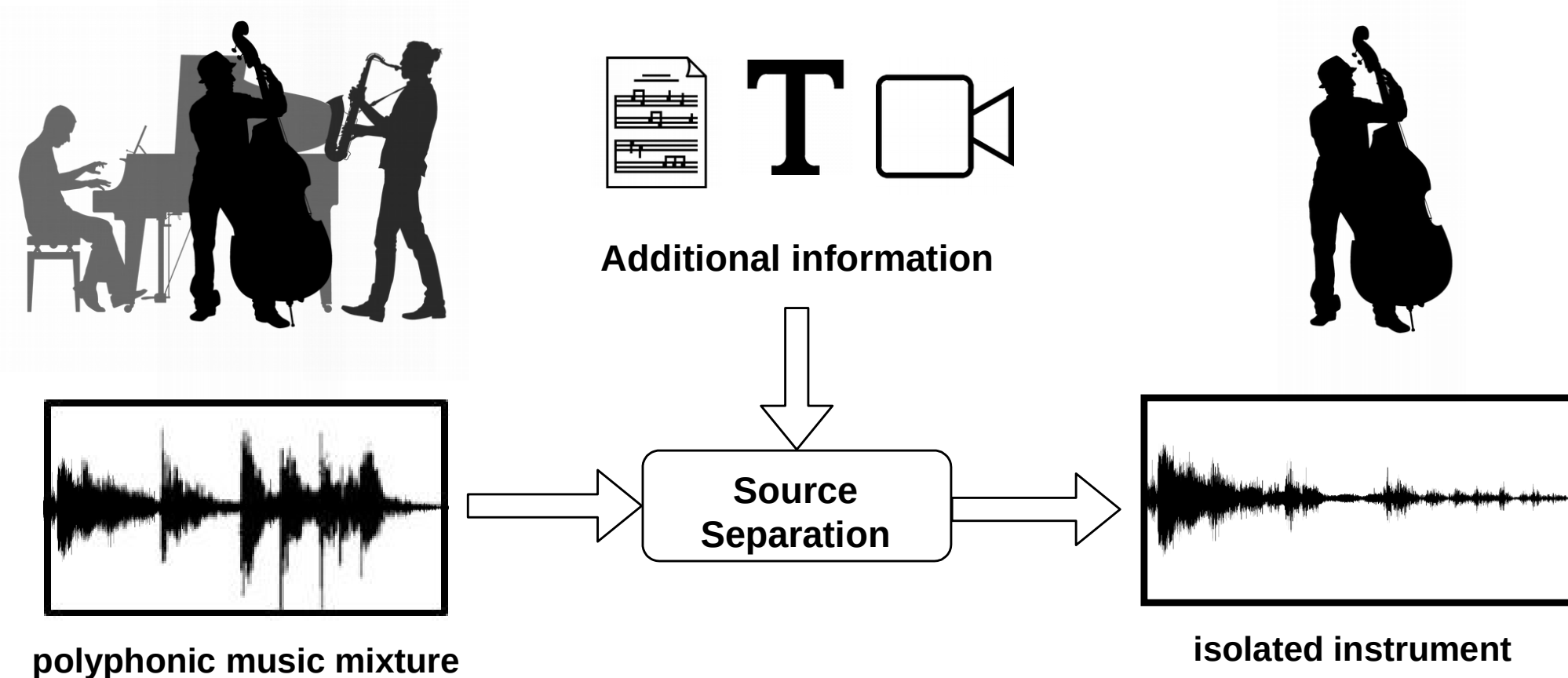


Figure 1: Informed audio source separation process

**Informed source separation** algorithms exploit all the available prior information about the sources (e.g. text, score, visual features) and the mixing process along with the audio signal to enhance the source separation process [4]. They perform better than the blind ones for music tasks.

## Attention-Driven Source Separation

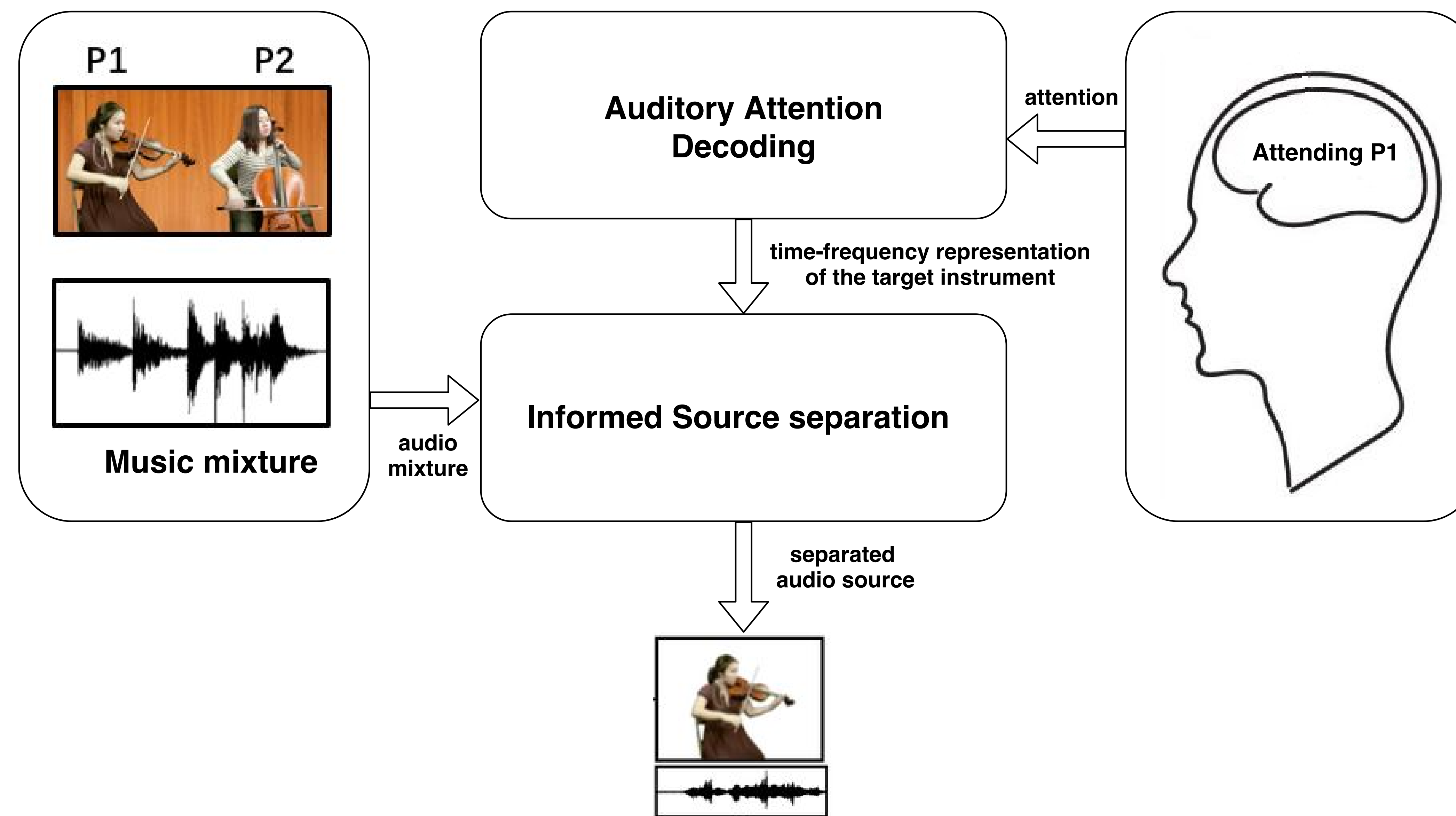
The user's attention can be used as a high-level **control/feedback** to select which, for him/her, is the target instrument to enhance. It would be useful for:

- General audience;
- Musicians;
- Sound Engineers;
- People with impaired hearing.

## Attention to sounds

Attention *is a set of processes that allow the cognitive system to **select relevant information** in a given context* [8] and it can be characterized in many ways.

There are a few works on **auditory attention decoding** from the subject's **neural activity** [6], but they focus mostly on speech and they had access to the **isolated audio sources**.



## Proposed Approach

**Multimodal source separation** which exploits modalities that have never been considered before such as the **user's attention** to the source.

The selective attention to the source will be explored first using only **audio stimuli**, and in a second phase using **audio-visual stimuli**.

The information extracted from the user while he/she is interacting with the music/video will be fully exploited to obtain:

- **source recognition;**
- **source estimation;**
- **source separation/enhancement.**

## State of the Art

### Speech stimuli

[2], [9], [5] tried to separate each sound source and use them to identify and enhance the attended speaker using the neural activity of the subject.

### Audiovisual stimuli

In **noisy/multispeaker scenarios**, the visual modality, enhances speech reconstruction [1], [3].

### Music stimuli

- **No previous work on music;**
- few works try to extract music information from the subject's neural activity;
- they all rely on extracting stimulus-related brain responses by averaging a high number of stimulus repetitions [7].

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