

Concept for the Investigation of Perceived Spaciousness in Music and Film

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Abstract

Sound fields are preferred when spaciousness is perceived over sound fields in which spaciousness is not recognized. Studies have been investigated spaciousness in rooms such as concert halls. In media science, audition has often been neglected while focussing on the visual aspect. This research project will investigate the role of music in audio-visual contexts such as films in respect of perceived spaciousness in one or more scenarios. Therefore, a concept for psychoacoustic experiments will be presented by introducing perception tests and measurements for objective comparison. It is expected that music will have an impact on the perception so that a film excerpt will be rated more spacious with music. In addition, the kind of music (e.g. instrumentation, number of instruments) will have an influence as well. Sound designers, film music composers, researchers and engineers will benefit from these results by getting a better understanding of how to compose music and how to use audio signals in an audio-visual context to yield a spacious experience.

Introduction

Spaciousness refers to an auditory effect of a characteristic propagation of a sound filling a larger room that is also perceived as such [1, p. 348]. It means the feeling that sound comes from many different directions, the opposite monophonic impression characterizes the feeling of the sound arriving at the listener through a narrow gap [2, p. 325]. A spatial sound is created from different aspects (figure 1). On the one hand, room acoustics (e.g. reverberation time, apparent source width (ASW), listener envelopment (LEV) [2, p. 325ff.], the recording, the reproduction technique and the audio coding [3] play a role. On the other hand, the audiomix of an audio file [4], the tonal space [5] and psychoacoustic aspects such as the spatial hearing processing [1] have to be considered.

Perception occurs as a process in several steps. It consists of the processing of sound (as an example for listening) that arrives at the listener's ears and is transformed into electrical signals. These electrical signals are further transmitted to the brain. A chain of processes takes place between the physical event in the external environment and the perceptual registration by the listener [6][7]. Thus, the internal representation can differ from the physical event after the processing.

The auditory perception does not only depend on auditory input but is also influenced by other modalities' input such as vision [8][9][10]. The visual input often dominates the auditory input which is shown by the ventriloquist effect [11] and the McGurk effect [12]. Another example is the perceived playing technique (bow

vs. pluck) in audiovisual, manipulated recordings when playing the cello [13]. Stirnat [14] could confirm the visual influence on the auditory perception. Visual media such as films and commercial videos work with music in a focused way on the other hand because music has a strong impact on the way the picture lane is transmitted [15][16]. That is why this research project yields to investigate the perception of film and music to better understand the relationship between them.

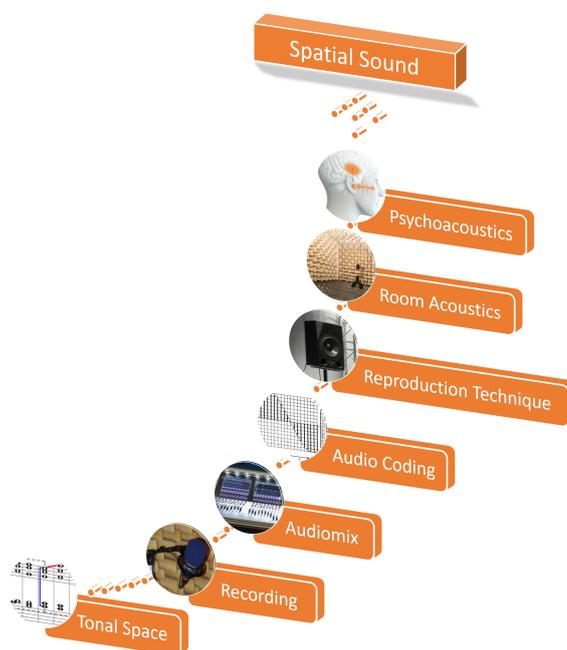


Figure 1: Aspects of a spatial sound production.

The research projects aims to find out more about the interaction between auditory and visual input in respect to spaciousness by answering the following questions:

- a) Does a film excerpt with music appears as more spacious than a film excerpt without music? If yes, what kind of music in respect to instrumentation, number of instruments and tonal space seems particularly spacious?

In terms of spacious characteristics of previous studies, individual aspects are to be considered:

e.g. a wide field: will it be perceived wider with music? What kind of music evokes the impression of wideness best und suits the film excerpt better?

e.g. an outer space: will it seem more infinite with music?

e.g. a big room: will it appear bigger with music?

- b) Will differences in the instrumentation and number of instruments in respect to spacious perception occur that will confirm the results of [14]?
- c) What is more important for a spacious perception: music or image in a film?
- d) Optional: Which role does the reproduction technique and the screen size play for a spacious perception?

The hypotheses belonging to the research questions are:

- H1: Audiovisual (AV) material will be rated the highest in terms of its spacious attributes, thus a film excerpt with music seems more spacious.
- H2: Music with several voices will have a stronger effect than music with only one voice.
- H3: Music containing a high amount of low frequencies will show a stronger effect on the spacious perception than music consisting of a low amount of low frequencies.
- H4: Music with string instruments will be rated higher in respect of spacious attributes than music with wind instruments.
- H5: Optional: Both the reproduction technique and the screen size will have an impact on the spacious perception.

Method

Excerpts will be shown to participants in several experiments which the participants rate in respect of spacious attributes. The excerpts consist of film excerpts with music (AV), film excerpts without music (visual (V)) and music excerpts without film excerpts (auditory (A)). The setup remains identical (room, technique, screen size, position of the participant) for all conditions within an experiment. The spatial attributes (big, wide, open, infinite, close, narrow, deep, hollow, artificial, rough, intimate, soft) from a previous study that was developed with Prof. Rolf Bader [17] are the basis for the experiment and can be rated on a 7-point-likert-scale. In addition, questions about the experience with perception tests, the authenticity and the naturalness of the excerpts will be asked, and on how well the (spatial) impression of the music suits the impression of the image layer.

As a realistic setting, a living room alike setup with 5.1 surround sound and a small screen will be used in the first experiment. Setup for follow up experiments can be varied in screen size, in reproduction technique and in audiomix. Depending on the results, it is also interesting to ask participants about the apparant source width (ASW).

The results of the experiments will be explained with objective measurement data and analyses of the music and film excerpts. All aspects for explaining the results of the experiments are shown in figure 2. The following

measures referring to spaciousness will be determined using artificial head recordings and measurements: interaural phase difference and the number of partials according to Ziemer [18], RL_E according to Blau [19], early and late reflexions in connection with apparent source width and listener envelopment according to Gade [2] and reverberation time.

The music excerpts will be analysed in the context of their spacious characteristics and the participants' evaluation: spectral centroid, frequency spectra and instrumentation.

Also, the film excerpts will be analysed by creating field size protocols and by describing features of spatial effects.

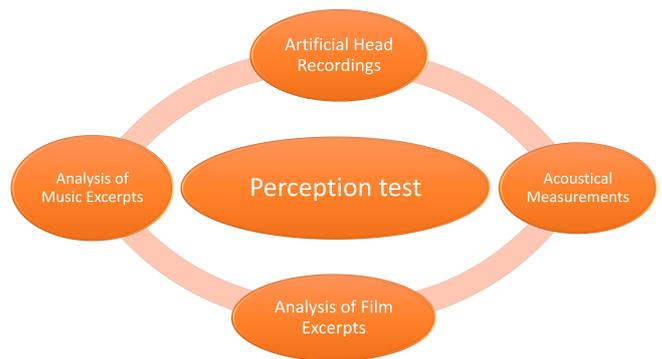


Figure 2: Overview of the methodological approach.

Relevance

The study of audition within media is often neglected while focussing on the visual part [20, p. 91]. This research project will counteract to this tendency. In entertainment, especially in cinemas, the halls are upgraded with new technologies to make the auditory reproduction more spacious and to make the cinema experience more impressive. The investigation of spaciousness as an important factor for a pleasant sensation of sounds (in room acoustics) will provide a deeper insight of the role of music in the spacious perception in films. Sound designers, film music composers, researchers and engineers in media will benefit from these results because a better understanding of the complex perception process is expected and the role of music in the interaction with technology, music and image in a film presentation becomes clearer. Considering these results, music can be used more specific to maximize the film experience.

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