

# Perceived spaciousness in music presented through headphones, loudspeakers and wave field synthesis

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**Background.** The perception of spaciousness has found increased interest in field of acoustics in the recent years because the importance of its influence on the perception of sounds has been revealed. People would rather listen with headphones than with loudspeakers, e.g. in listening studies (Kallinen and Ravaja, 2007). One possibility to avoid this issue could be to conduct studies with the wave field synthesis acting as a virtual headphone which Laumann, Theile and Fastl (2008) have designed. This work is motivated by the results of a former study in which participants were asked to evaluate spaciousness while listening with loudspeakers. The participants heard music from five different musical genres with 30 excerpts for each genre. The study demonstrated that the investigated genres allow classifications of certain spatial features such as "big", "wide" and "open" (Stirnat, 2012). In contrast to the former study, it will utilize stereo loudspeakers, headphones and wave field synthesis to conduct another hearing test in which participants will experience all three technical conditions. Also participants will listen to only 30 excerpts of mixed genres and instruments.

**Questions and Hypotheses.** This study will concentrate on answering the following questions: Firstly, how do we perceive spaciousness in music itself with the different technical devices? Secondly, what are the differences in the perceived spaciousness when participants listen with loudspeakers, headphones and wave field synthesis? Thirdly, is it possible to replace headphones with wave field synthesis?

The results will lead to conclusions of the pros and cons of the various technical configurations. One hypothesis is that there will occur technology specific attributes for the perceived spaciousness in music. Another hypothesis is that there will be music-specific attributes for the perceived spaciousness.

**Method.** The methodology used for this study will consist of a hearing test including twelve pictures showing spatial attributes that will be rated on a numeric scale as well as dummy head recordings for an objective comparison.

Keywords: Acoustics, Music Perception, Psychoacoustics, Spaciousness

## References

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