Determining the area of the sweet spot in a surround loudspeaker setup for various microphone techniques

Nils Peters  
Schulich School of Music,  
McGill University Montreal

Jonas Braasch  
School of Architecture,  
Rensselaer Polytechnic Institute (RPI)

Stephen McAdams  
Schulich School of Music,  
McGill University Montreal

Background
Several types of microphone techniques exist to record music performances for surround sound reproduction. All the arrays are targeted to produce an accurate spatial impression at the sweet spot.

Does the microphone technique affect the size of the sweet spot, the area in which the spatial cues are reproduced with sufficient accuracy?

Hypothesis
Spaced microphone techniques lead to larger sweet spot areas than a coincidence microphone technique.

The microphone techniques
- Spaced Omnis
- Polyhymnia Pentagon (Bach)
- Decca Tree (Mozart)
- Optimized Cardiod Triangle - OCT
- Soundfield Ambisonics

A detailed description of the microphone arrays and the recording procedure can be found in [1] and [2].

The music
- J.S. Bach, Variation 13, Goldberg Variationen (BWV 988), [1]
- W.A. Mozart, maurische Trauermusik c-minor (KV 477), [2]

Method
- Playback of the 5.0 recordings, using the speaker system in Tanna Schulich Hall
- Binaural recording of the wavefield using a B&K dummyhead at different positions in the hall

The B&K dummyhead at the sweet spot

Independent variables
- 2 musical excerpts
- 3 microphone techniques
- 13 listening positions in the hall

Listening experiment
- 9 trained listeners (sound recording students) with normal hearing, aged between 22 and 35
- Excerpts of the binaural recordings (each ca. 7 sec.) were presented by headphones
- Pairwise comparison of the reference stimulus, (recorded at the sweet spot) with a stimulus recorded on another listening position
- Each pair was presented twice

Results
- Distance to the sweet spot is the most significant factor in degradation of listening quality (p < .000)
- Significant effect caused by the microphone technique (p < .001) can be observed at position 1 - 6

There is an interaction between the musical excerpt and the recording technique

Conclusion
- The microphone technique influences the size of the sweet spot
- Although these results are preliminary, the sweet spot tends to be increasable by using a spaced omni microphone technique

References

Future work
- Repeat the binaural recording in other halls
- More subjects for the listening experiment
- Repeat the binaural recording in other halls

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