

Introduction to Principles of Spatial Audio Technology

Spatial Audio: Physics and Perception

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Outline

- 1 The problem With Reproduction
- 2 Definitions

What is Good Reproduction?

Traditionally, spatial audio technology and surround sound technology in particular is primarily concerned with the spatial reproduction of previously recorded sound fields.

This happens according to the notion of truthfulness or fidelity to the originally recorded sound field.

If all technical parameter can be controlled, this results in an objective, truthful reproduction. . .

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The Concert Goer

The concert goer's expectations on the recording are most probably to hear the music as if she or he was in the best seat of the house.

So she would like a spatial recording of that sweet spot, i.e. she expects this form of perspective on the spatial representation also in her home.

The sweet spot is expected to be large and unchanging in relation to where the listener is in a room, ideally the sweet spot moves with the listener to the kitchen when putting the kettle on.

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Student in a lecture hall

The student in the lecture hall wants to understand the speaker, the truthful spatial representation is of no interest,

In fact, the student wants the spatial representation to be overcome, and warped to the effect that the speaker sounds close, loud and clear

The whole point of the reproduction here is to warp the original sound field.

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Listener in a cinema

Audio cues to enhance immersion in the happenings on the screen.

The screen is already a warped and limited representation of the visual world

We want to hear the directors aural perspective of the happenings on screen, we are interested in his virtual space, not a truthful representation

Aural perspective as an artistic means of shaping the virtual space.

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VR Gaming Environment

The idea is that every participant gets an individualised, unique perspective on the happenings

With the participant's movement through space, the perspective is expected to change.

Reproduction of a an audio space without sweet spot and something akin to *truthful* spatial reproduction might indeed be of interest here!

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To summarise, the problem with the reproduction of spatial audio is that the listener always introduces and expects a perspective.

From this, and various other points in this early sessions, it should become clear that a integrative and multi-modal approach to technology development becomes necessary

If you were to develop such an integrative, listener focused system, what sort of work-flow would you suggest? - Keeping in mind the listeners perspective and the multi-modality of perception...

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...for after the break

assignment

How do you define....

- Space
- Sound
- Perception
- Spatial Sound
- *Technology?*

Space

For our purposes we have to sometimes differentiate between imagined (virtual), and real (physical) space.

We can experience space by positioning ourselves in relative positions and directions to objects.

Whereby "positioning" inherently implies a movement within space.

What's essential here: Both real and imagined space can be perceived!

This applies to both real (physical) and imagined (virtual) space.

Space is three-dimensional; objects and events have relative positions and directions in it

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assignment

How many senses do we have?
What are they?

The Senses

- vision
- auditory
- somatic (touch)
- gustatory (taste)
- olfaction (smell)
- vestibular (balance/movement - also in the ear)

Note we don't have a dedicated sensory organ for Space!!

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Spatial Audio

Traditionally, spatial audio technology presumed a listener in an auditorium listening to audio which surrounds her or him three dimensionally.

More often than not, this happened and happens in fact two dimensionally, without elevation.

With the increased importance of spatial interactivity the listeners fixed position in relation to the sound sources can not be presumed anymore as given

Spatial audio describes a dynamic relation between a listener and a sound source, and very often both the source and the listener move through space.

Spatial audio is audible sound with spatial cues perceivable through a listeners (dynamic or stationary) position within auditory space.

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...our definition includes not only spatial cues based on sound source localisation, but also spatial characteristics of the room (e.g., reverberation) and also spatial aspects of a mono source in relation to a listener.

By this definition, the experience of walking towards a ringing telephone is an example of interactive spatial audio. ;)

Also walking around town with an iPod is thus interactive spatial audio, that is, if the listener takes note of the space around her or him and brings it into relation of the sound on the headphones.

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Read: Garity 1941, Fantasound

<http://www.widescreenmuseum.com/sound/fantasound1.htm>