How to Find Future Audio Formats?

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How to Find Future Audio Formats?

Content

1. General classification of audio reproduction systems
2. What is important for future audio formats?
3. Why height sound-reproduction?
4. Questionnaire for a future audio format
5. Taxonomy for audio formats
1. General Classification of Audio Reproduction Systems

Reproduction systems
- Physically based
  - Wave-Field Synthesis
    (<2 kHz for a loudspeaker distance of 17 cm, microphone array, only 2D reproduction) [Berkhout 1988, Fraunhofer IDMT 2009]

- Perceptually based
  - Mono
  - 2 channel Stereo
  - 5.1 Format [Rumsey 2001]

- Both categories (dependent on number of loudspeakers)
  - Ambisonics [Gerzon 1973]
1. Transport Format versus Reproduction System

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Transport Format</th>
<th>Reproduction System</th>
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<tbody>
<tr>
<td>~1923</td>
<td>Mono</td>
<td>Mono</td>
</tr>
<tr>
<td>~1961</td>
<td>2 ch. Stereo</td>
<td>2 ch. Stereo</td>
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<tr>
<td>1993</td>
<td>5.1 PCM, MPEG Layer II, AAC, Dolby Digital, DTS</td>
<td>5.1 Multichannel [ITU-R BS.775 1994]</td>
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<td>2007</td>
<td>MPEG Surround (32 ch.)</td>
<td>Dolby 7.1, DTS 7.1</td>
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<td>2010</td>
<td>MPEG SAOC (Spatial Audio Object Coding)</td>
<td>TH 10.2, NHK 22.2</td>
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<td>?</td>
<td>?</td>
<td>?</td>
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</table>
2. What is Important for Future Audio Formats or Systems?

What is present in current systems?
- Speaker/instrument recognition (timbre)
- Room recognition (reverberance)
- Localization information in Stereo
- Envelopment in 5.1 (in 2D)

What should be present in future systems?
- Localization information in 3D
- Room perception in 3D
- ?

What is not subject of this investigation
- Meta data [Fraunhofer IDMT 2009b]
- Interactivity, e.g. [Silzle 2004]
- Multi-modal systems, e.g. [Altinsoy 2006]
- Bit resolution, sampling frequency
2. Current Attempts for Future Audio Systems with Height Information

- Ambisonics (Gerzon, 1973) [Ambisonic 2007]
- Ambiophonics (Ralph Glasgal, 1995) [Glasgal 1995]
- 10.2 System (Tomlinson Holman, 2000) [Holman 2000]
- 2+2+2 System (Dabringhaus, 2001) [Dabringhaus 2009]
- 22.2 System (NHK, 2004) [Hamasaki 2004]
- DTS-HD, 7.1 (DTS, 2006) [DTS 2009]
- Dolby Pro Logic IIz, 9.1 (Dolby Laboratories, 2009) [Dolby 2009]
- ...
3. Why Do We Need Height Sound-Reproduction?

- Direct sound sources from above (static or slow moving)
  - Singing bird
  - God’s channel (speaker from above)
  - ?
- Screen related sound sources from different heights
- Recording room reflections from above
- Height is the last missing dimension in reproduction
3. What Do We Like to Achieve with Height Sound-Reproduction?

- Same step size of improvement in Overall Quality like Mono – Stereo – 5.1 – n.m
- Precise localization of height from the front and above
- Plausible auditory width or spaciousness for elevated auditory events
- Plausible reverberance (room perception)
- ?

**Constraints**

- Number of reproduction loudspeaker n between 5 and 22
- System should work with different numbers of loudspeakers
4. Questionnaire for a Future Audio Format

1. For which applications is a new audio format with height reproduction
   1.1 Radio
   1.2 TV
   1.3 Cinema
   1.4 Gaming consoles
   1.5 Internet
   1.6 Car
   1.7 ...

   Scale  0 – not necessary
   1 – less important
   2 – important
   3 – very important

2. Number of loudspeakers and positions (azimuth and elevation in degree)
3. What else is important?

   Thank you very much for participation!
5. Benefits from the Taxonomy

- Necessity to collect the influencing factors
- Overview of influencing factors
- Structure of the whole problem
- Multivariate optimization problem
- Possibility to quantify the problem
6. Summary

- General classification: Physically and perceptually based reproduction system
- What is important: Last missing dimension – height
- Questionnaire for a future audio format
- Taxonomy for audio formats to get an overview
Thank you very much for your attention!
Please return the filled questionnaire.
Any questions?
7. Literature