



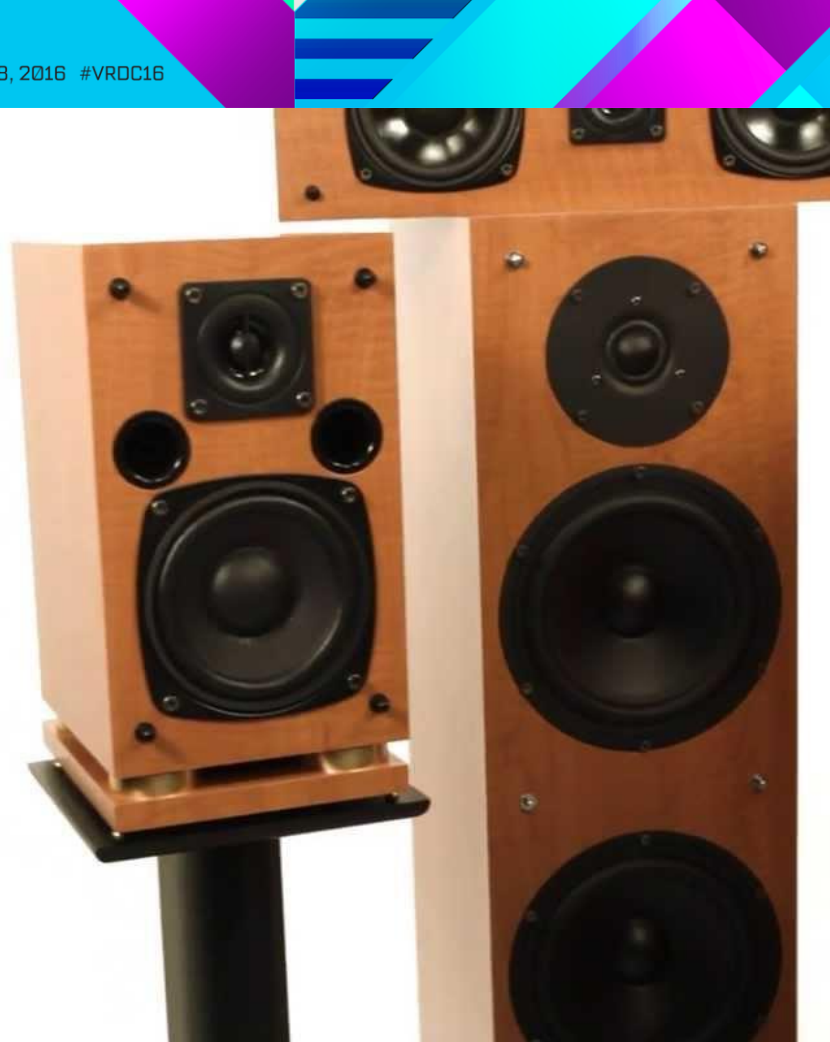
Evaluating Binaural and Ambisonic Audio Capture and Playback

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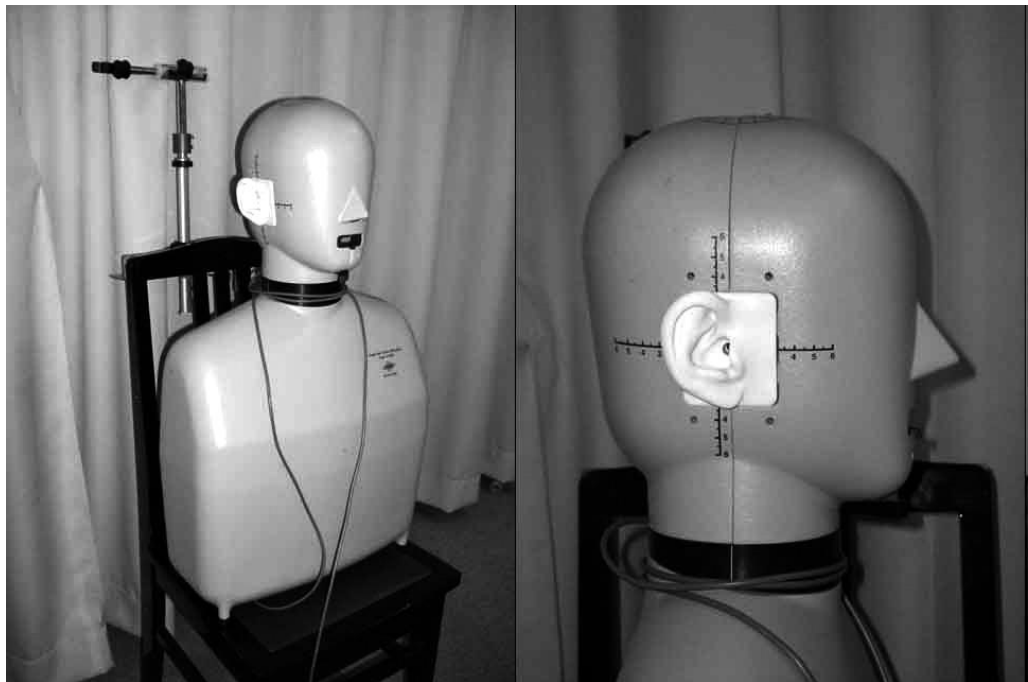
Conventional Audio

- Speaker based
- Front focused
- Uncontrolled listening conditions



Binaural Audio

- Microphones placed in ears
- Playback in headphones



Binaural in VR

- Binaural capture in multiple directions
- Blend based on listener's head rotation



Ambisonics

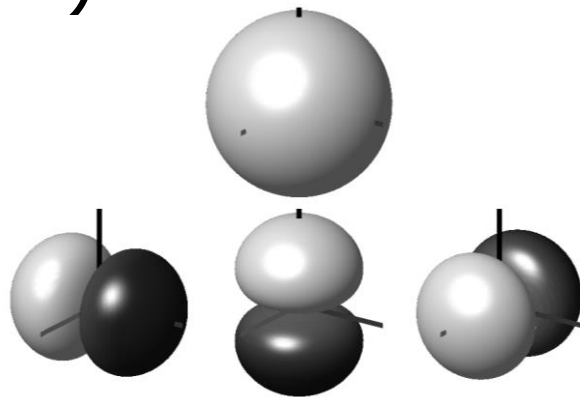
- Describes a 3D sound field
- Audio format is independent of playback configuration
- Audio channels represent directional sound pressure



Ambisonic B-format

1st Order has 4 channels (WXYZ)

- W channel is omnidirectional
- X Y Z channels represent directional sound pressure along the X, Y and Z axes



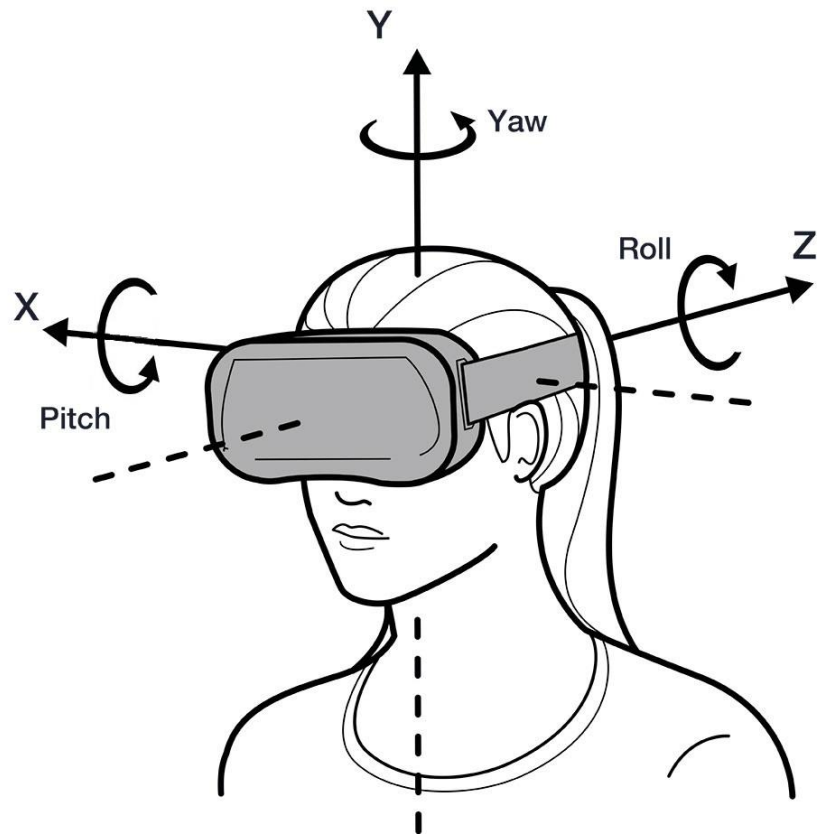
Ambisonic Capture

- Four microphone capsules
- Raw 4 channel capture is called A-Format
- A-Format is then converted to B-Format



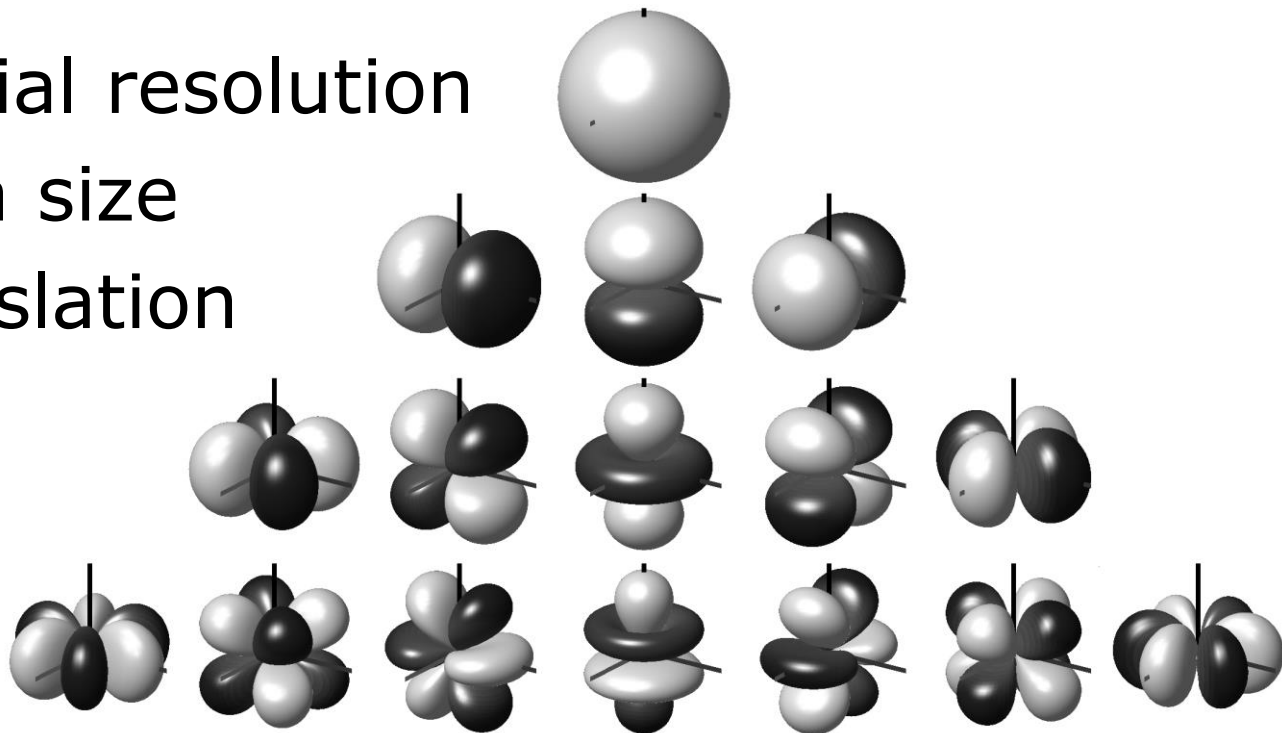
Ambisonics in VR

- Spatialized at playback with HRTF
- Supports rotation in all directions



Higher Order Ambisonics (HOA)

- Better spatial resolution
- Larger data size
- Allows translation



Comparison

Ambisonics

CoreSound TetraMic

Quad-binaural

3Dio FreeSpace Omni



Spatialization Accuracy

- Quad-Binaural
 - Only yaw rotation
 - Dummy head spatial cues
 - Phase cancellation
- Ambisonics
 - 1st order has low spatial resolution



Environmental Reflections

- Live recording captures reflections
- Reinforces visuals
- Enhanced sense of presence



Audio Quality Comparison

- Binaural housing causes coloration
- Ambisonic has flat frequency response



Price Comparison

Quad-Binaural

3Dio FreeSpace Omni	\$2499
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3Dio FreeSpace Omni Pro	\$5499
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Ambisonics

Brahama	\$899
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Core Sound TetraMic	\$1329
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TSL SoundField	\$3000+
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Delivery

Container

- MP4, VPx

Lossy Compression

Watch out for:

- LFE lowpass
- Stereo channel-coupling



Conclusion

- Binaural creates a solid 3D image
- Ambisonics have a flatter frequency response
- Reflections are amazing