



Chapter 7

Surround and Spatial Sound

Outline

Human Sound Localization

Binaural Audio

In-Head Localization

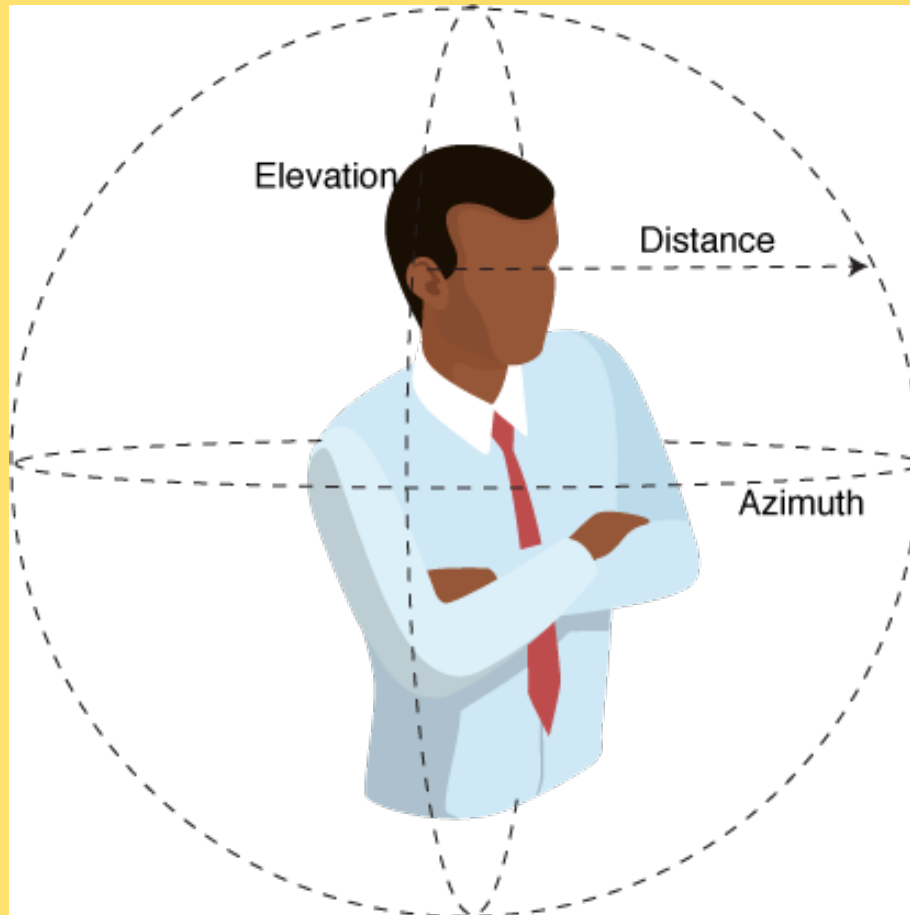
Surround Sound

Ambisonics and Object-Based Audio

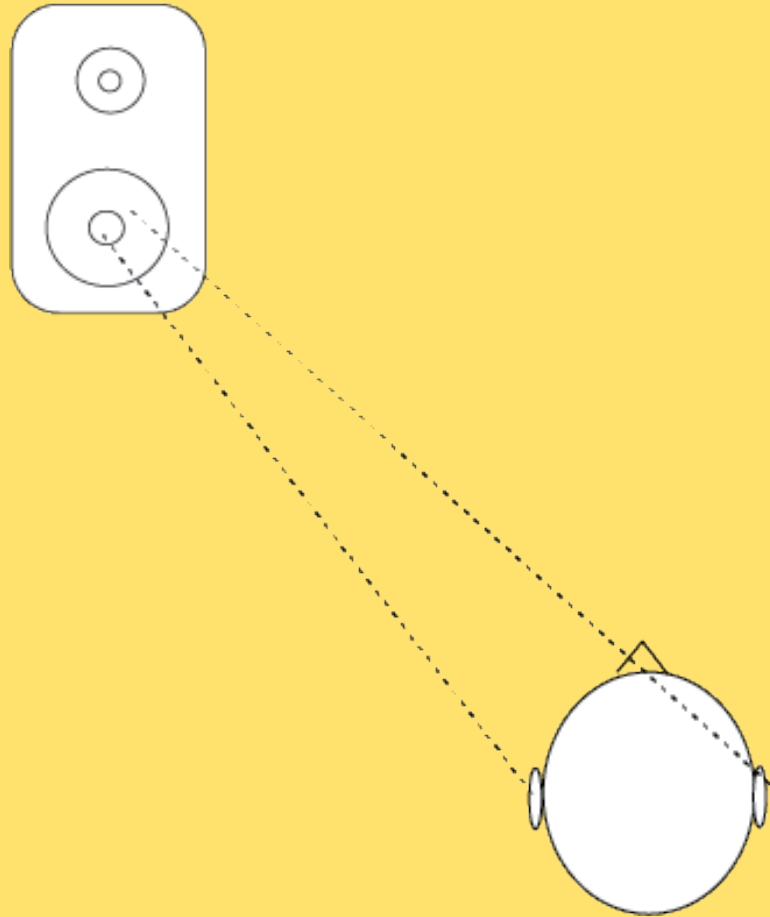
Spatial Sound

Sound Propagation

Human Sound Localization



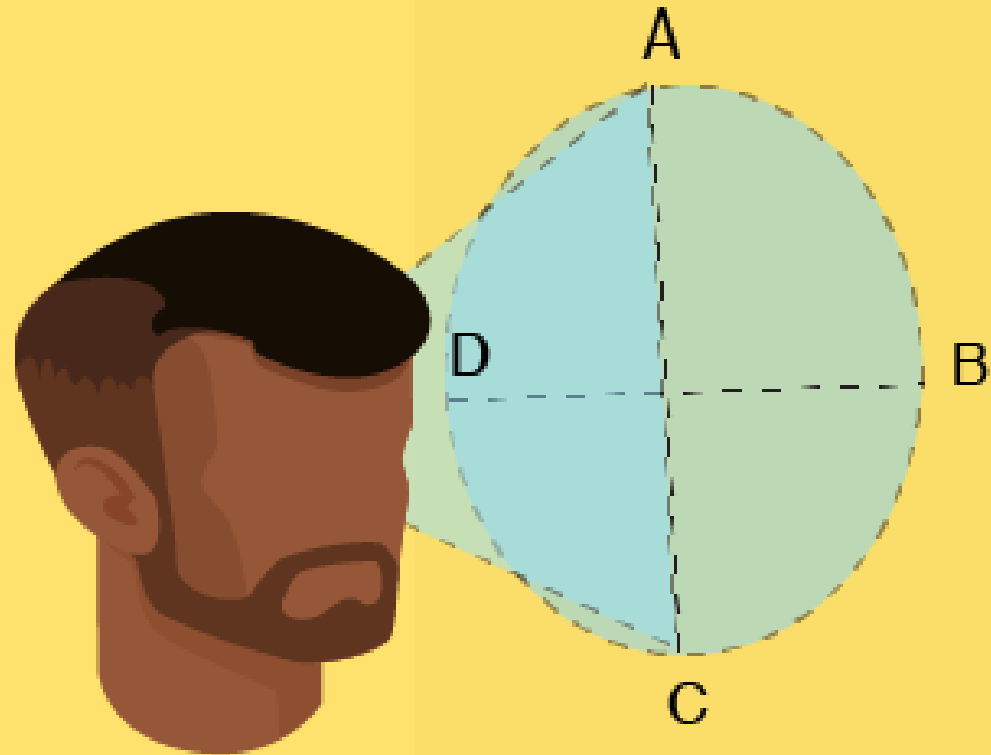
How sounds reach our ears



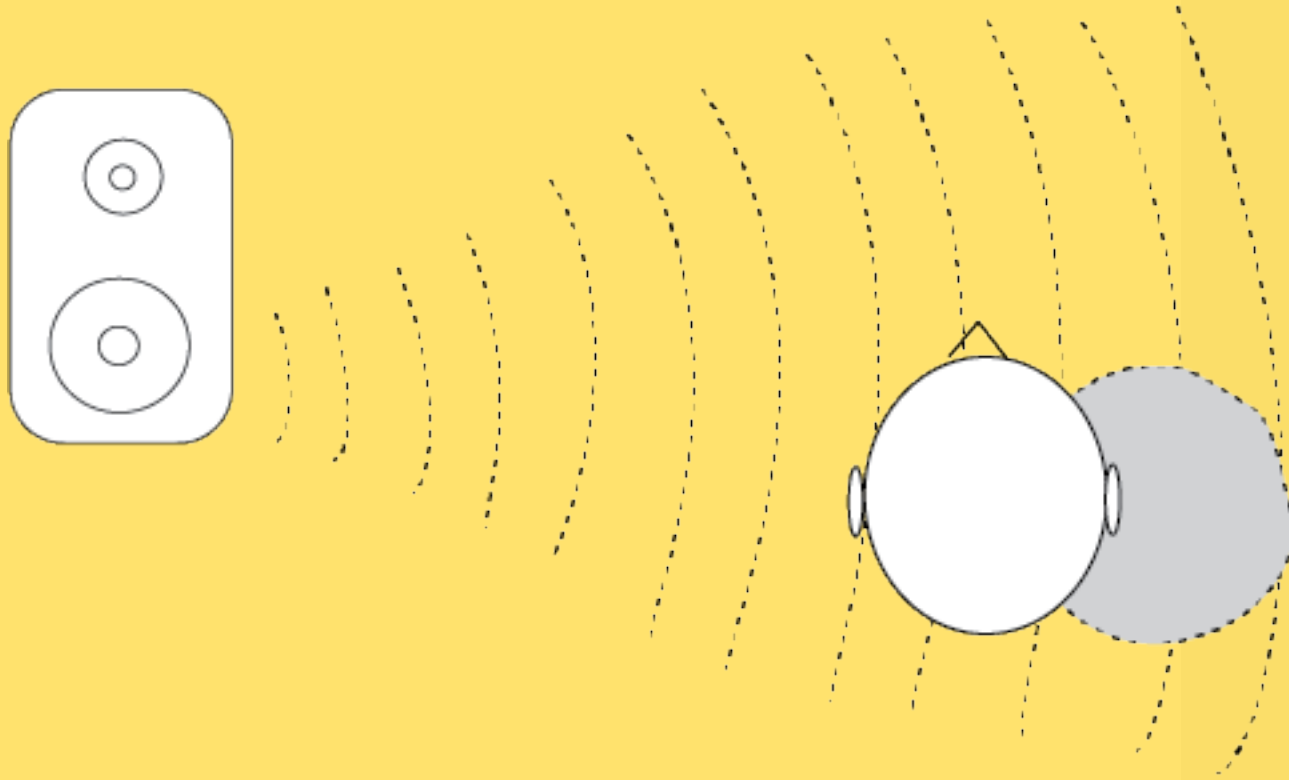
ILD: Interaural Level
Difference

ITD: Interaural Time
Difference

Cone of Confusion



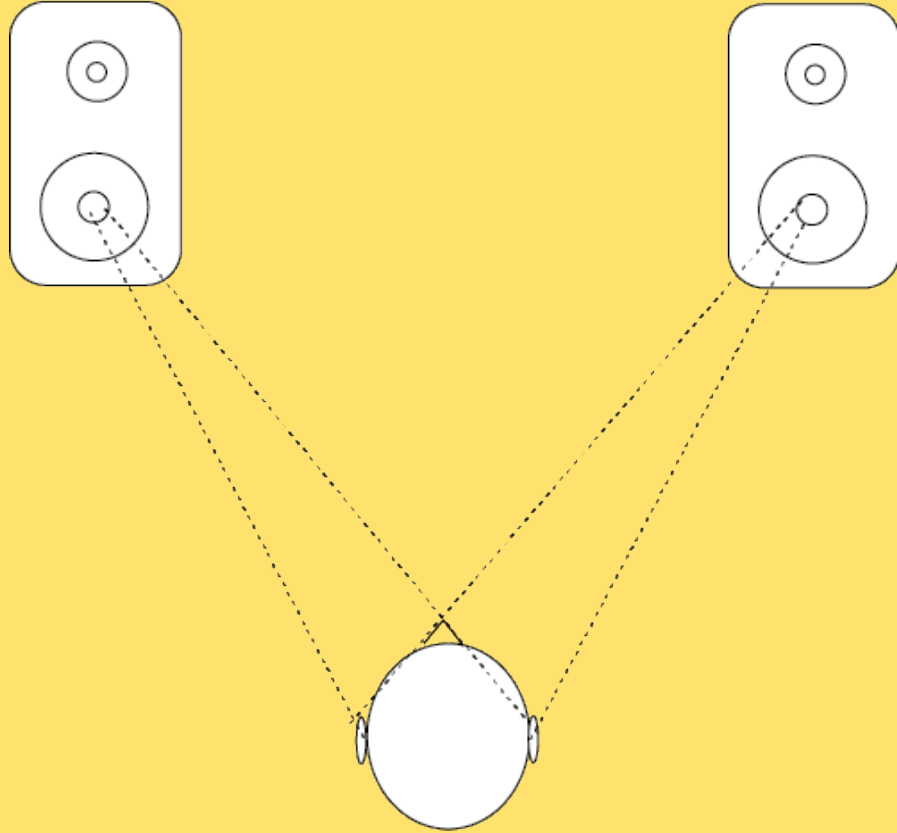
How sounds reach our ears



Spectral cues

HRTF: Head
related transfer
function

Binaural Audio



Two channel audio: two ears
Cross-talk over speakers
Headphones: isolate one channel

Binaural recording



Neumann.com



3dio.com

- Not just 2 mics, requires head(ish) & pinnae for HRTFs

Binaural Plug-ins

- Ambeo Orbit (free) in Audition

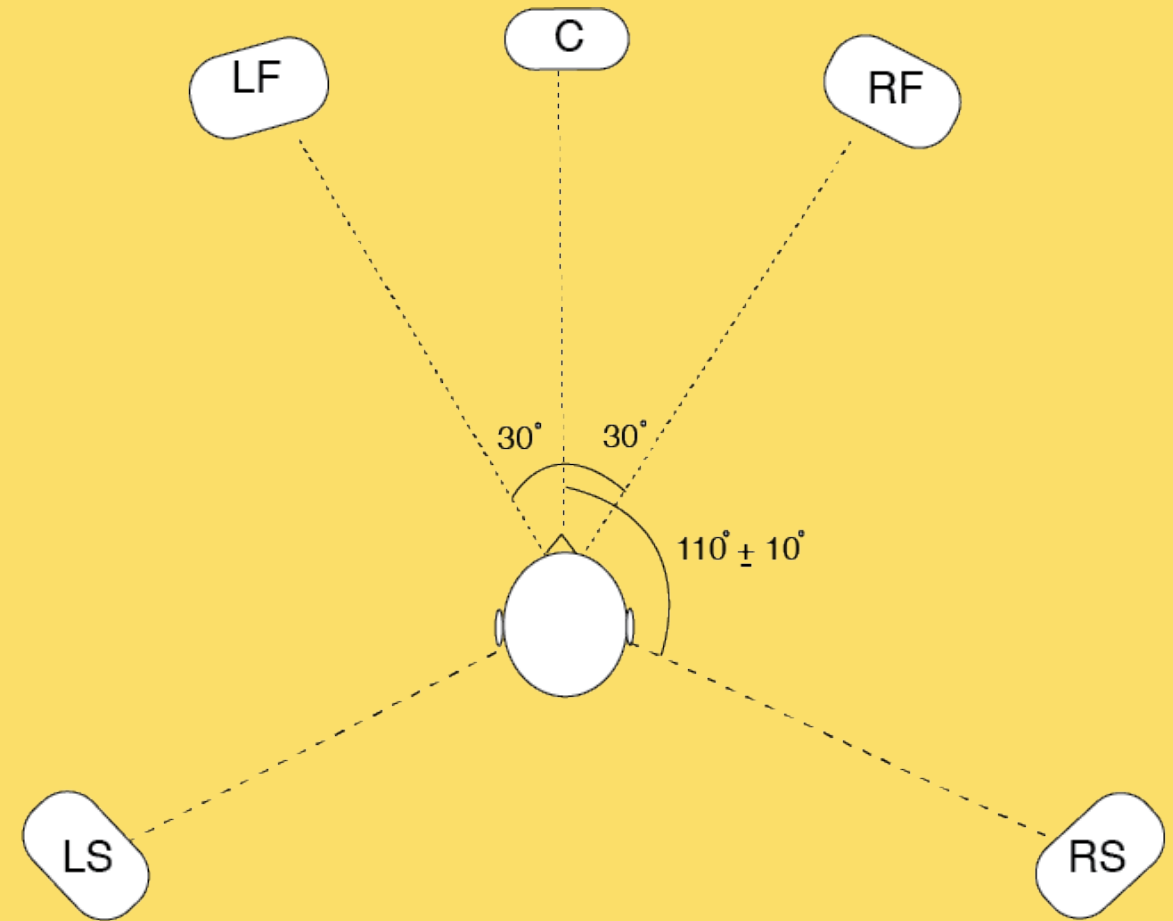


In-Head Localization



Surround Sound

- Two channel audio: two ears
- Cross-talk over speakers
- Headphones: isolate one channel



Surround mixing in Audacity



File>Export>Export as Wav then hit Save.

Advanced Mixing Options window

The Exit Sign effect

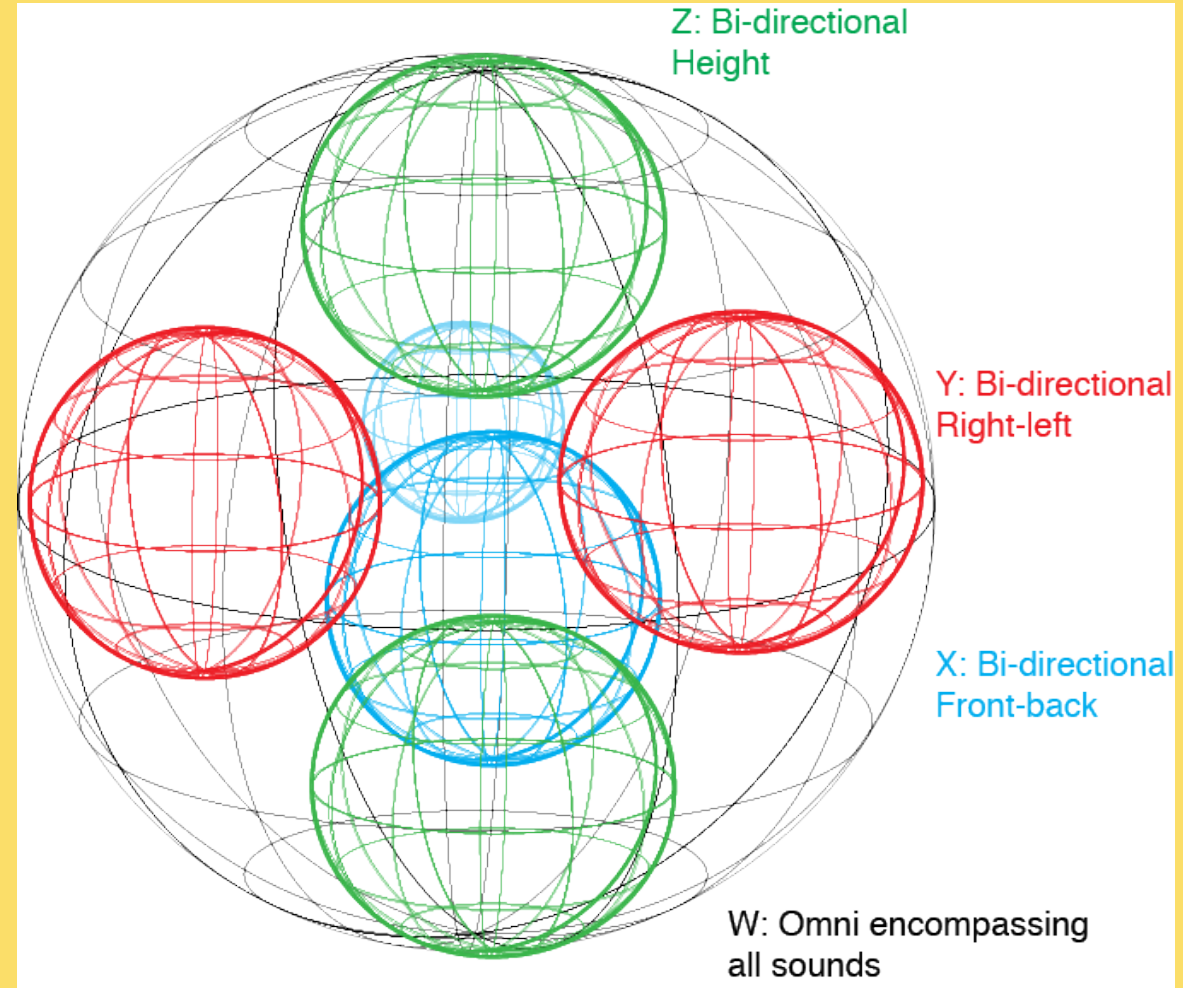


EXIT

Spatial Audio Rendering

Ambisonics

- Encoding: B-Format: 4 channels, W, X, Y, Z
- W: omni
- X: figure8 pointing forward
- Y: figure8 pointing left
- Z: figure8 pointing up



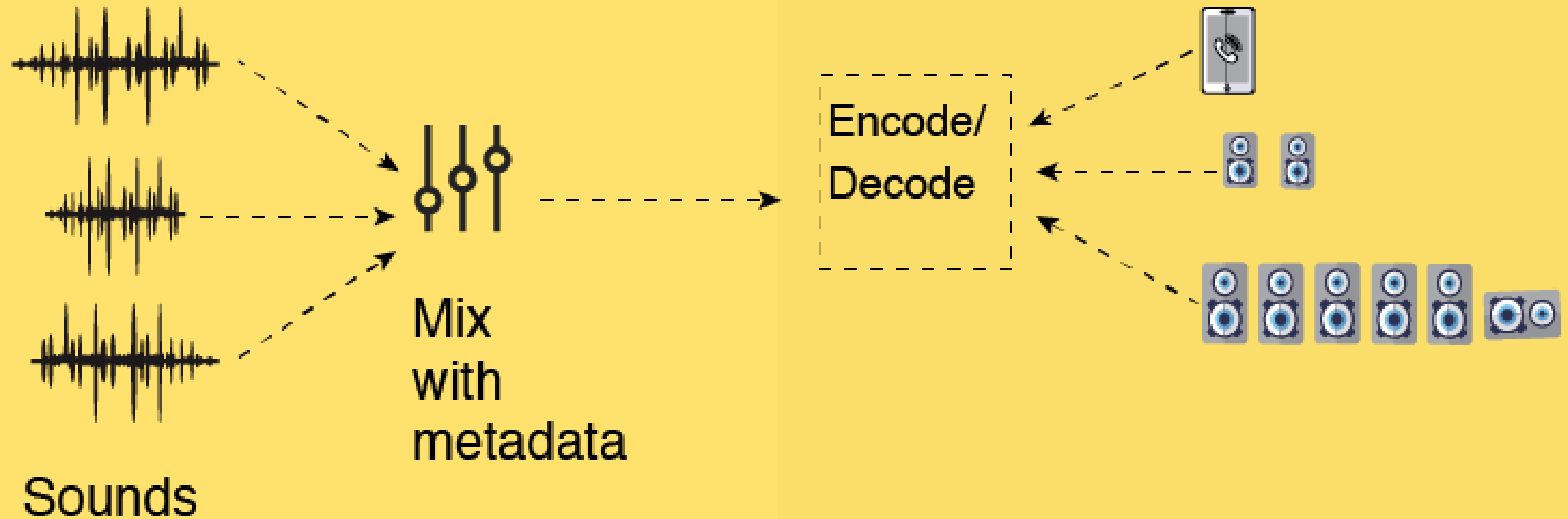
Ambisonics mixing tools



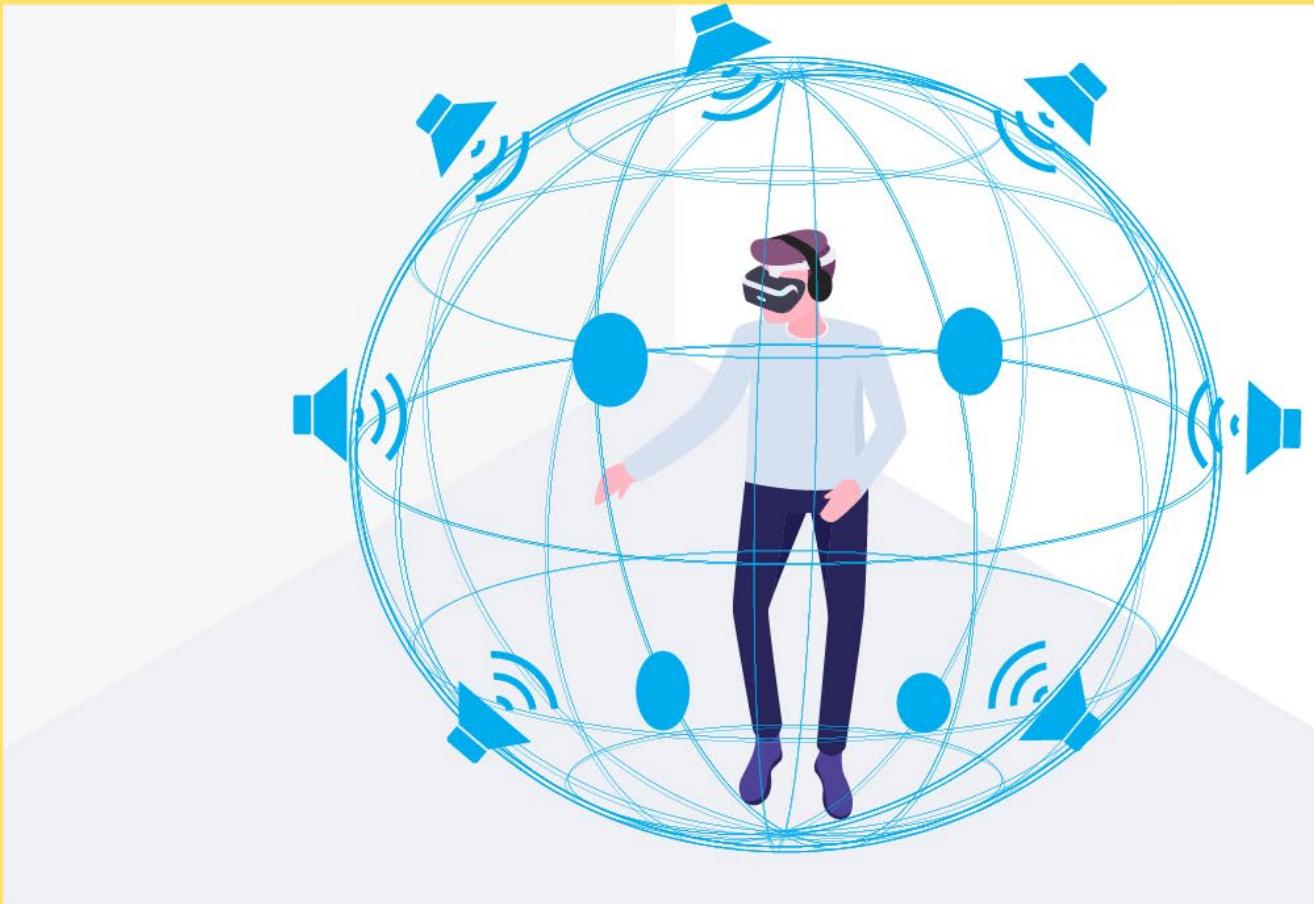
Waves B360

<https://www.waves.com/plugins/b360-ambisonics-encoder>

Object-based Audio



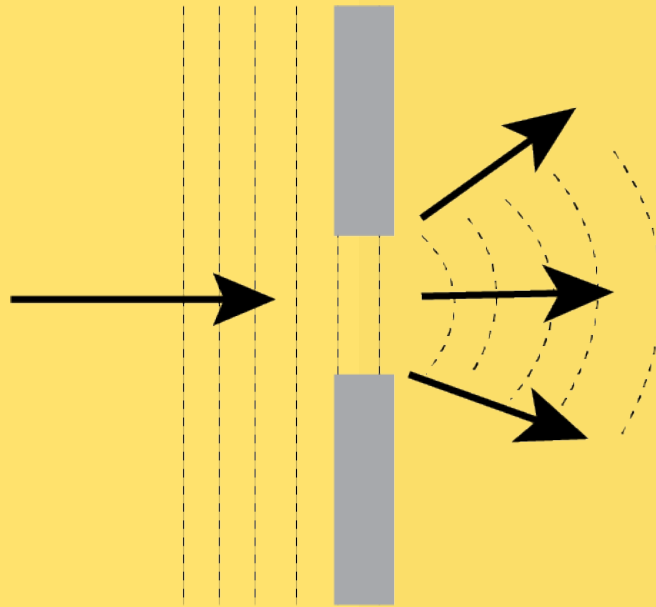
Spatial Audio



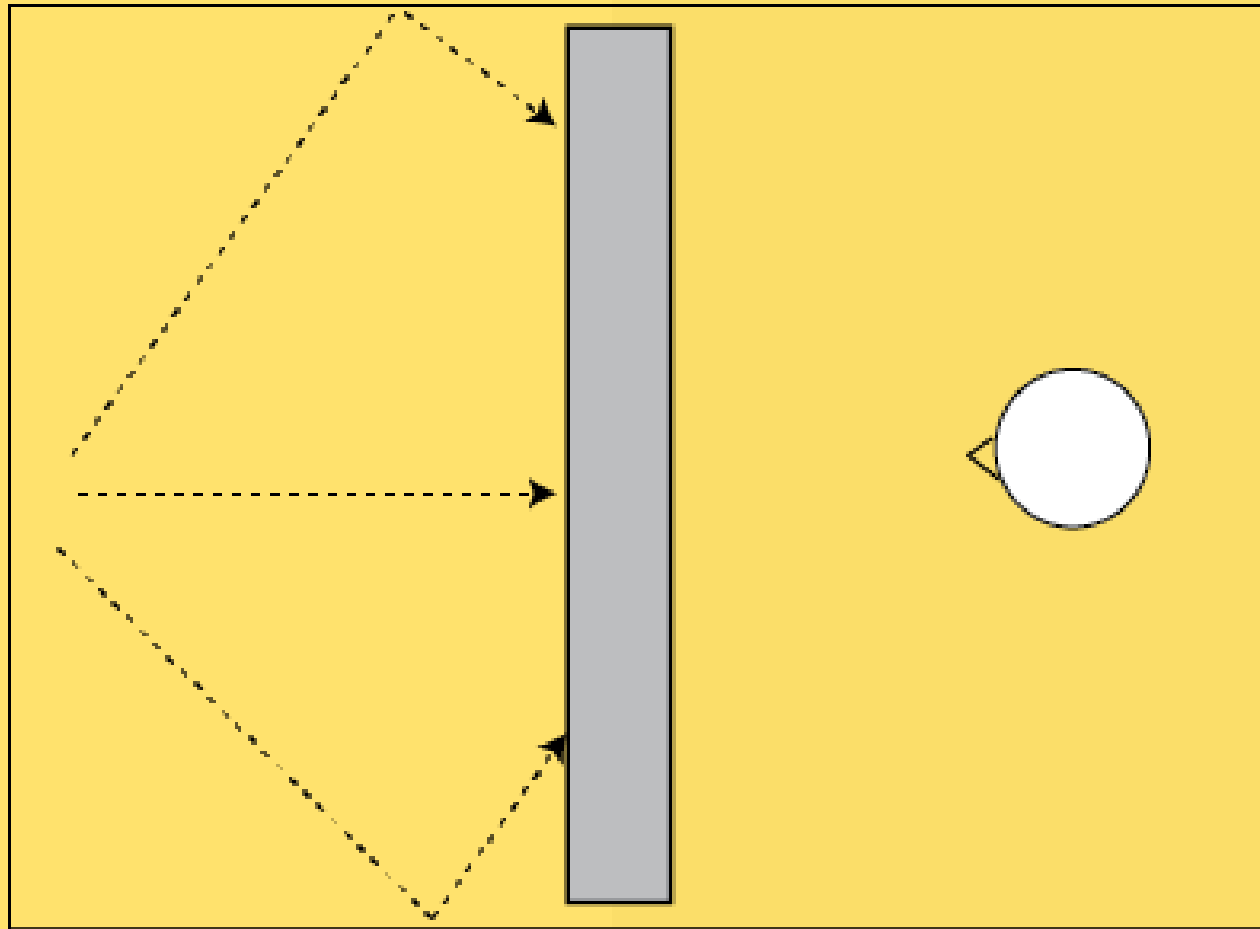
Rendering
software based
Head-tracked vs
Head-locked

Sound Propagation

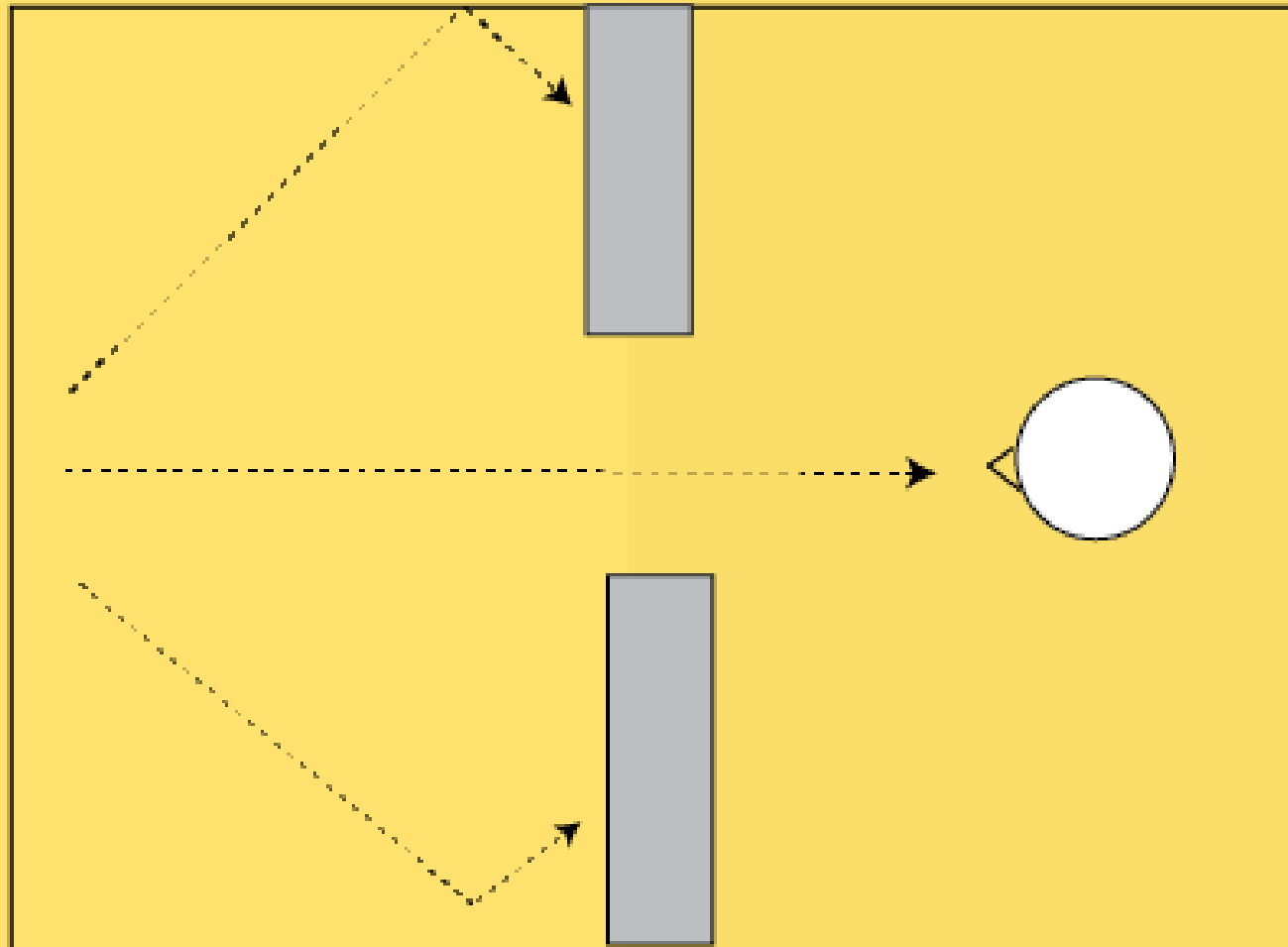
Diffraction: Path of sound around obstacles



Sound Propagation: Occlusion



Sound Propagation: Exclusion



Sound Propagation: Obstruction

