Binaural Cues

- Head-Related Transfer Function (HRTF)
  - Computed from recordings of localized sources with in-ear probe mics
Audio Spatialization (aka Localization)

- Use HRTFs to process audio
  - Realism
  - Separation of sources can make them more understandable
  - But, doesn’t account for environment

Auralization (aka Sound Rendering)

- Generate sound field by modeling interaction of sources with environment
- Usually defined to include potential application of HRTFs
  - E.g., https://www.youtube.com/watch?v=ibM3fz-P0Ac

R. Mehra, L. Antani, and D. Manocha, ICAD 2014
Uses of Audio in 3D UIs

- Location cue
  - Accomplished through spatialization
  - With environment modeling, communicates spatial context
- Realistic ambient sound
- Sonification (aka Auralization [a different use of the term!] or Audification)
  - “Sonic visualization” to map information to sound
- Sound track
- Annotation
  - For example, narration
- Sensory substitution
  - For example, to indicate physical contact

Audio in Unity

- Overview
  - https://docs.unity3d.com/Manual/Audio.html
- Audio listener attached to user (camera or user GO)
  - Affected by being in a Reverb Zone
  - https://docs.unity3d.com/Manual/class-AudioListener.html
- Audio sources attached to GOs
  - Controls distance-related volume attenuation, Doppler effect
  - https://docs.unity3d.com/Manual/class-AudioSource.html
- Reverberation
  - https://docs.unity3d.com/Manual/class-AudioReverbZone.html
- Doppler effect
  - https://docs.unity3d.com/Manual/class-AudioManager.html
- HRTFs
  - https://docs.unity3d.com/Manual/AudioSpatializerSDK.html
- Tutorials
  - https://unity3d.com/learn/tutorials/s/audio