

Abstract: Real-Time 3D Audio Rendering

While real-time graphics is getting better and better, realistic audio is trailing behind by a couple of years. Having realistic real-time 3D audio would be a big step towards better immersion. While audio has to be less spatially sensitive than graphics, the timing is more significant, since sound is comparatively slow. Following this there are some effects that are crucial for immersion. Spatial audio is important for the user, for him to be able to locate the audio source. The challenge here is, that a delay of barely 1ms from different directions results in a clear localisation in the brain. Additionally reverberations are hearable after only 10ms of delay and late reverberations like echo can still significant after seconds. An additional difference to audio is the frequency. Audio has magnitudes lower frequencies resulting in higher wavelength and therefor a bigger importance of diffraction. This results in the effect of portaling. One example of this is heard in doors or windows when the sound is hearable from this direction directly, instead of the real audio source. The span of hearable wavelengths is also quite big, resulting in the challenge of having to sample a higher frequency-space.

These challenges can be approached by different methods. The most common are wave-models to simulate audio physically accurate. However, there are also methods using ray tracing to approximate filters for specific effects or to calculate the intensity directly, which is computationally more efficient than wave-models.

This work will focus on adapting techniques of computer graphics to accelerate the computation of realistic real-time 3D audio. One possible approach for this is path reuse in Bidirectional Path Tracing. Since there are a lot of unsolved challenges in the field of 3D Audio the possibility for project extension is given as well.