

Defining an Audio Production Pipeline for Mixed Reality

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What I do

■ Audio Producer:

- Recording engineer
- Mixing engineer
- Mastering engineer
- Surround recording, mixing, and mastering
- Composer
- Sound designer
- Audio for mixed reality

■ Research Associate:

- Auditory perception
- Experiments in 3D audio
- Pervasive sound systems
- Science of sound design
- Exploring mixed reality audio



Pine & Flutter Productions

- Private production & surround studio
- Films: Kris: Vibrations, A View of Christmas
- Surround Mixing: Stella Sung's "Karma"
- Local bands and art installations
- Changing the world of surround sound and auditory entertainment...eventually



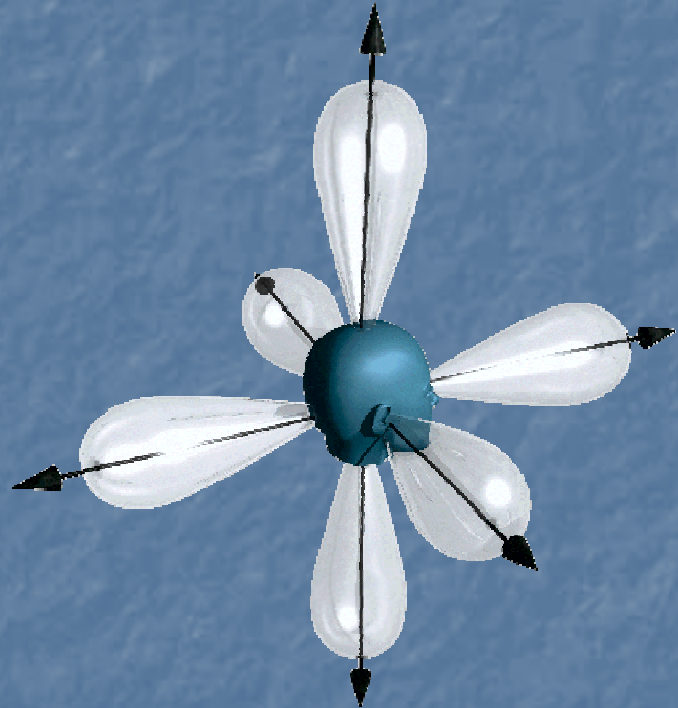
MCL Titles

- MR MOUT I-III (IITSEC, PEOSTRI)
- MR Aquarium (IAAPA)
- MR Time Portal (SIGGRAPH 2003)
- MS ISLE (ISMAR 03)
- MR SeaCreatures (OSC)
- MR Cartoon (Nickelodeon)



Audio for Simulation. Why Care?

- 360 degrees
- Hear through walls, around corners
- Communication
- Environmental recognition
- Increased sense of presence & immersion
- False/negative training



Production Pipeline: Audio for MR

- Planning & Prescripting
- Capturing
- Synthesizing, Mixing, and Mastering
- Designing Sound & Integrating
- Delivering

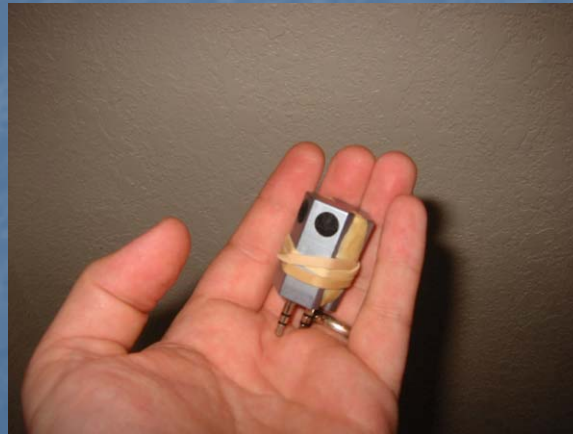


Capturing



Capturing

- Hydrophones
- Surround Mics
- Holophone
- Custom Creations
- Binual
- Transducers
- Mobile



Design Techniques

- Typical Approach:
 - Many sound designers rely upon sound effects libraries
 - Unfortunately, these approaches rarely yield believable results due to the lack of spatial depth and acoustic reality.
- Alternative Approach:
 - Capturing ambience and effects in surround can increase immersion and presence in interactive experiences

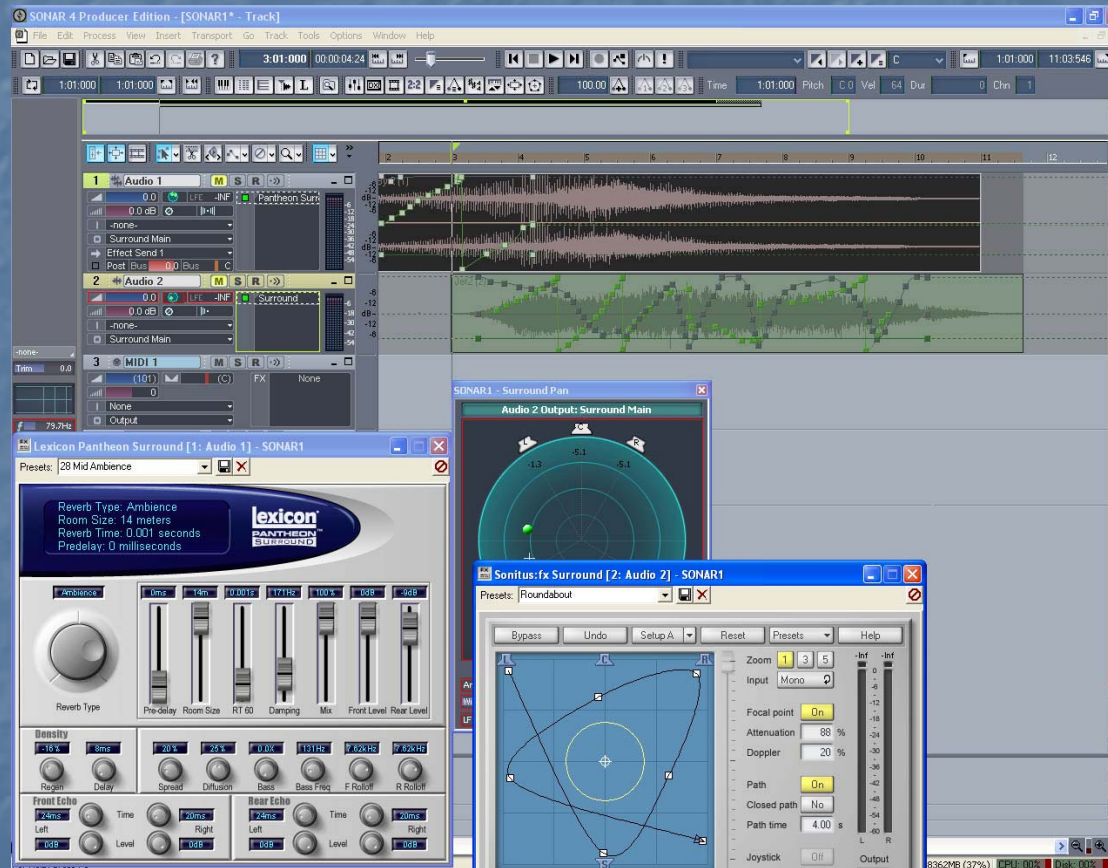


Mobile and Location Recording

- Capture audio in many different environments – field recordings, remote locations
 - Mini-disc
 - Flash-drive devices
 - Firewire w/ laptop
- Mobility vs. quality can be an issue to consider



Synthesizing, Mixing, & Mastering

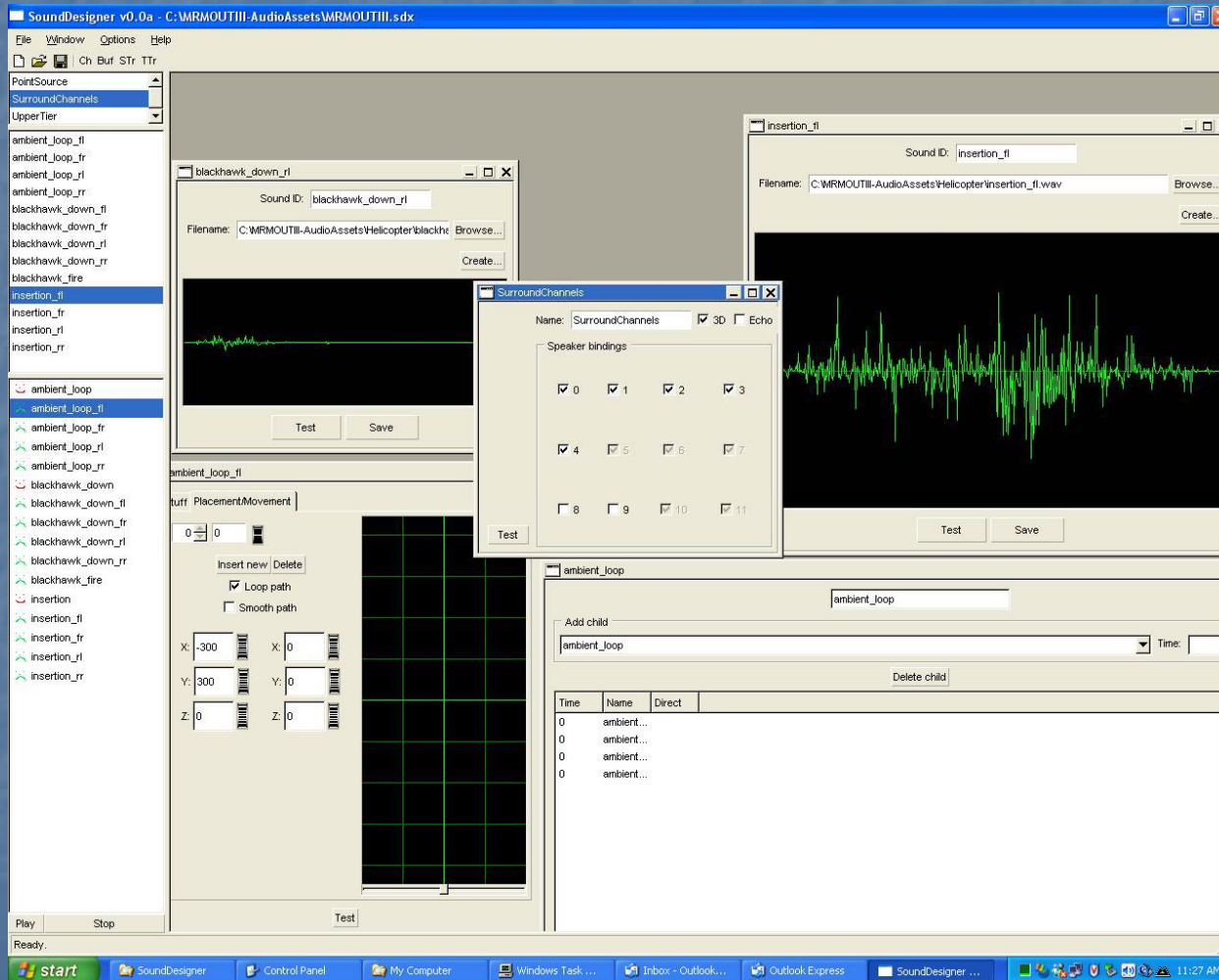


Synthesizing, Mixing, and Mastering

- Pulling together captured sources, synthetic sources, SFX libraries
- Layered atmospheres
- Special effects
- “More real than real”
- Surround Mixing



Sound Design & Integration



Why build a high-level audio interface?

- SIGGRAPH 03, ISMAR 03, IITSEC 02/03, IAAPA 02/03, Orlando Science Center, US ARMY's STTC
- Sound designers, trainers, scenario creators should not be burdened with code
- Audio production tools such as ProTools, Sonar, etc. do not provide support for real-time spatialization, dynamic control, or non-standard speaker configurations
- We need a system that can provide a sound designer with a full set of tools and controls that meet the demands of interactive/immersive simulation



Existing Tools

- EAX – very common API used in gaming and simulation
 - Does not however, provide low-level support for creation of DSP effects, or allow direct control over output channels.
 - Cannot create point source channels
- 3D headphone systems (such as AuSim 3D) while providing realistic 3D impressions are only suitable for VR applications where real-world audio is blocked out or unnecessary



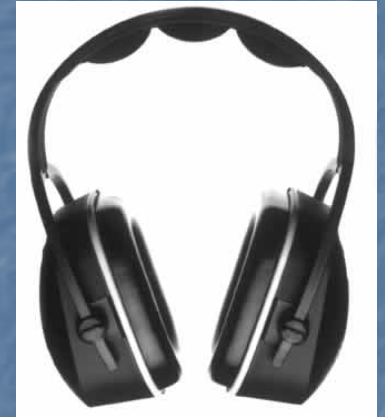
SoundDesigner

- Custom audio engine built upon the low level audio API – PortAudio
- Features include
 - Support for 3D sound
 - Assignable channels (3D, point source)
 - Multi-tiered speaker configurations
 - Configurable speaker placement
 - Real-time spatialization
 - User placement compensation
 - Time-line triggers
 - Prescribed paths with waypoints (linear and curved)
 - Real-time capture and playback of sound (with full SoundDesigner support)
 - Basic DSP (echo, reverb)
 - Savable configuration files
 - Standard features: looping, volume control, envelopes
 - Ability to address multiple sound cards



Delivery

- Headphones
- Loudspeakers
- Earbuds
- Ultrasonic
- Point Source
- Haptic Audio



Delivery Devices

- Multiple surround configurations depending on venue
 - Multi-tiered systems for vertical sound simulation
- Point source speakers embedded in props
- Headphones or earbuds for personal audio
- Ultrasound for virtual speakers and intimate audio
- Haptic audio for information cues and special dramatic effects



Additional Considerations

- Perception, expectation, and the intuitive mind
- “Artistic research” and validation of production techniques



Questions???