



**TAKE
CONTROL**
www.gdconf.com

MARCH 5-9
2007
SAN FRANCISCO

MOSCONE
CENTER



CMP



Multichannel Audio: Techniques For a Hi-Def Experience



Who am I?

⊕ Bryan Pearson

- ⊕ Audio Programmer for Infinity Ward's CALL OF DUTY 2 (XBOX360/PC)
- ⊕ Worked with Mark Ganus, Infinity Ward's Audio Director
- ⊕ Currently an Audio and Tools Programmer at Treyarch



Why are we here?

- ③ Multichannel audio can, and should, be more than simple panning of sounds
- ③ Use our systems and/or use them as a jumping off point for your own
- ③ Take Control of all your speakers
- ③ Most of all, do what's best for your game



SoundAlias – Definition

- ⊕ Provides a level of indirection between the game and sound files
- ⊕ References one or more sound files, optionally multiple times
- ⊕ Currently about 25 tweakable parameters
- ⊕ A .csv table, easy to iterate on



SoundAlias – Simple Example

name	file	vol_min	vol_max	pitch_min	pitch_max
typewriter	beep1.wav	0.55	0.55	0.2	0.25
typewriter	beep1.wav	0.45	0.55	0.25	0.3
typewriter	beep2.wav	0.55	0.75	0.3	0.35



Non-spatialized Sounds

- ⊕ Traditionally music and ambient tracks
- ⊕ Sounds tied directly to the camera
 - ⊕ Player movement and weapons
 - ⊕ Radio chatter
 - ⊕ Announcer in multiplayer



SpeakerMaps

- ③ Control placement of non-spatialized sounds among any combination of your speakers
- ③ Specify a volume percentage for each speaker
- ③ That percentage is combined with the sound's runtime volume for its final speaker volume



ambience.spkrmap

⊗	MONOSOURCE	LEFTSPEAKER	0.30
⊗	MONOSOURCE	RIGHTSPEAKER	0.30
⊗	MONOSOURCE	CENTERSPEAKER	0.10
⊗	MONOSOURCE	LFESPEAKER	0.10
⊗	MONOSOURCE	LEFTSURROUNDSPEAKER	0.15
⊗	MONOSOURCE	RIGHTSURROUNDSPEAKER	0.15



ambience.spkrmap

⊕	LEFTSOURCE	LEFTSPEAKER	0.70
⊕	LEFTSOURCE	RIGHTSPEAKER	0.00
⊕	LEFTSOURCE	CENTERSPEAKER	0.00
⊕	LEFTSOURCE	LFESPEAKER	0.10
⊕	LEFTSOURCE	LEFTSURROUNDSPEAKER	0.30
⊕	LEFTSOURCE	RIGHTSURROUNDSPEAKER	0.00
⊕	RIGHTSOURCE	LEFTSPEAKER	0.00
⊕	RIGHTSOURCE	RIGHTSPEAKER	0.70
⊕	RIGHTSOURCE	CENTERSPEAKER	0.00
⊕	RIGHTSOURCE	LFESPEAKER	0.10
⊕	RIGHTSOURCE	LEFTSURROUNDSPEAKER	0.00
⊕	RIGHTSOURCE	RIGHTSURROUNDSPEAKER	0.30



A Quad-ratic Formula

- ⊕ Spatialized sounds are only sent to the quads
 - ⊕ LFE doesn't provide directionality
 - ⊕ Center channel often the weakest speaker
 - ⊕ Also, likely to be calibrated differently from the Quads
 - ⊕ Quads provide a full 360-degree soundscape



A Sub Standard

- ③ LFE Percentage
 - ③ A per-SoundAlias value
 - ③ Specifies a percentage of the SoundAlias' final volume to send to the LFE
- ③ Along with SpeakerMaps, the sound designer has complete control over LFE



Take Control

- ③ Health
 - ③ Heartbeat.spkrmp that only outputs to LFE
- ③ Sniper Scope
 - ③ Bring down the LFE
 - ③ Collapse the Quads into Center speaker



Candid Camera

- ⊕ Movies often have a fairly static ambient field
 - ⊕ Ambient sounds are positioned to a speaker for a scene and then left there
 - ⊕ Otherwise the audience would be disoriented



Spatializing vs. CutScene

- ⊕ Listener is historically tied to the camera
- ⊕ Spatialize
 - ⊕ Sound jumps around as camera pops to different angles
 - ⊕ disorienting
- ⊕ Non-Spatialized CutScene
 - ⊕ Sound is misplaced once the cutscene ends
- ⊕ Which do you Pick?
- ⊕ Both!



Cinematic Listener

- ⊕ When cutscene starts, declare a position and orientation, the Cinematic Listener
- ⊕ Tag sounds as “Cinematic”
 - ⊕ If a Cinematic Listener exists, they will spatialize to it
 - ⊕ Otherwise, spatialize to the camera



Nature Abhors A Vacuum

- ⊕ Typically games are hyper-spatialized
 - ⊕ Panning can be an over-simplification, pinpointing the sound excessively
 - ⊕ No bleed over into adjacent speakers
 - ⊕ Creates a vacuum sensation
- ⊕ Solution Criteria
 - ⊕ Prevent vacuum effect
 - ⊕ Maintain directionality
 - ⊕ Maintain overall power level



Omni-Directional Percentage

- ⊕ Specifies a % of each speakers volume to remove and divide evenly among all speakers
- ⊕ 0% represents hyper-spatialized
- ⊕ 100% represents no spatialization
- ⊕ CALL OF DUTY 2 used 25%



Pseudo-Code Algorithm

- ⊗ for (each speaker)
 - ⊗ $\text{removeAmount} = \text{speakerVol} * \text{ODP};$
 - ⊗ $\text{speakerVol} -= \text{removeAmount};$
 - ⊗ $\text{removeTotal} += \text{removeAmount};$
- ⊗ for (each speaker)
 - ⊗ $\text{speakerVol} += \text{removeTotal} / \text{speakerCount};$



Center Percentage

- ⊕ Issue: Had to pick out mission critical dialogue
- ⊕ Auto-ducking was used
- ⊕ Additional option: Center Percentage
 - ⊕ Modifies Omni-Directional Percentage
 - ⊕ Shunts a portion of volume to Center speaker
 - ⊕ The difference in playback grabs the player's focus



Envelop Zone Emitter

- ③ Simulate a sound so loud in real life that it seems to envelop you
- ③ Envelop Zone Emitter candidates
 - ③ Tank engines
 - ③ Grenade explosions
 - ③ Hydro-electric generators



How does it work?

- ③ 3 values per SoundAlias
 - ③ EnvelopMinDist
 - ③ EnvelopMaxDist
 - ③ EnvelopPercentage
- ③ Beyond EnvelopMaxDist, use Omni-Directional Percentage
- ③ Within EnvelopMinDist, use EnvelopPercentage
- ③ In-between, linearly interpolate from the Omni-Directional Percentage up to the EnvelopPercentage



Q & A