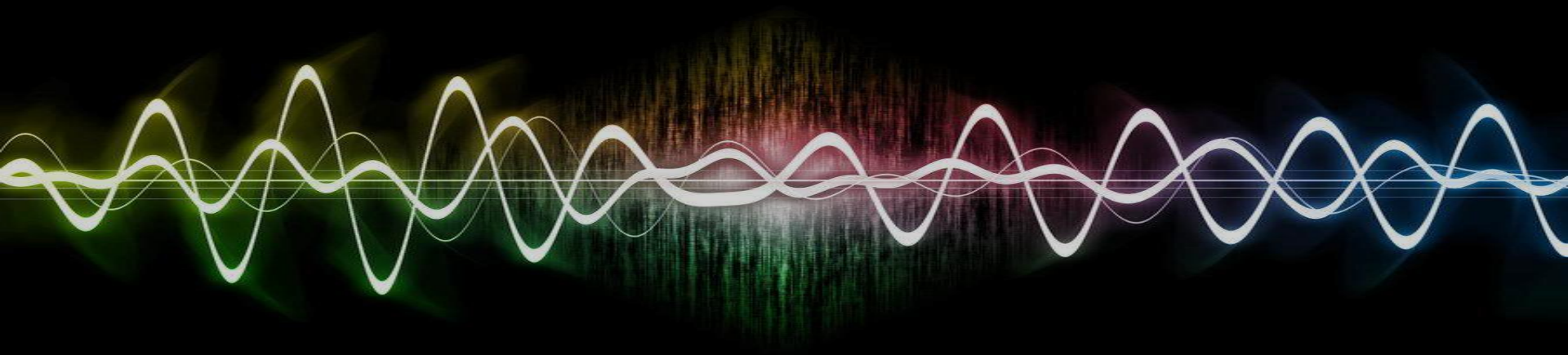


# IMGD 4000 Guest Lecture: “Audio in Game Development”



Keith Zizza, IMGD Professor of Practice (Game Audio)

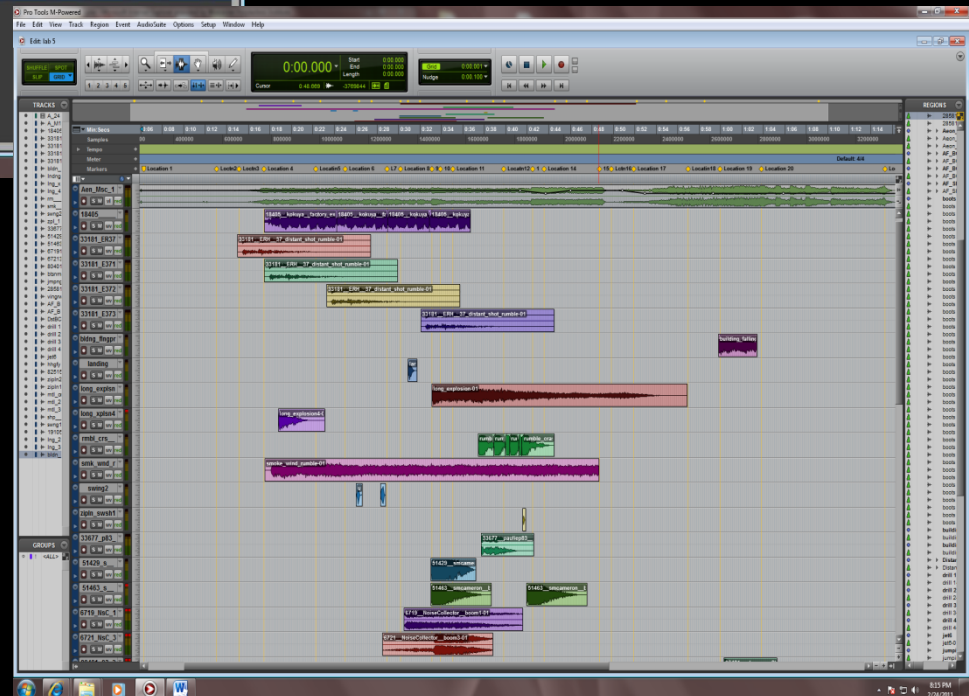
[kzizza@wpi.edu](mailto:kzizza@wpi.edu)

Office: Salisbury Labs 205

# Keith Zizza, IMGD Professor of Practice



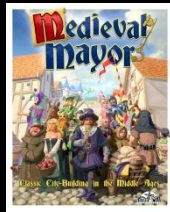
- Active in Game Industry for 17 years
- Specializing in Game Audio



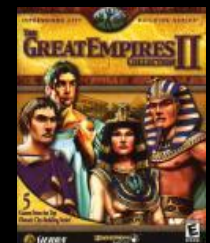
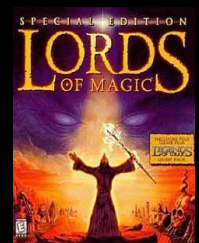
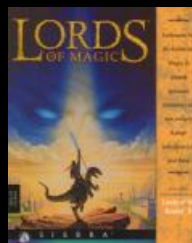
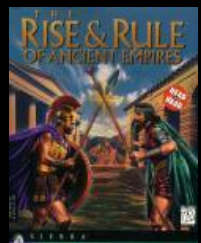
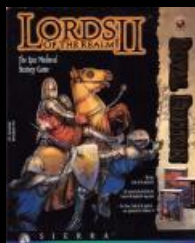
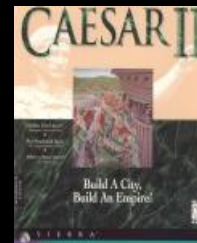
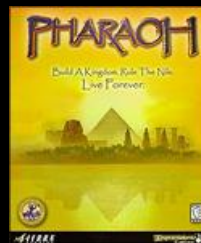
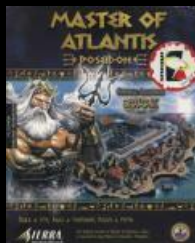
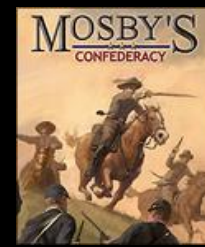
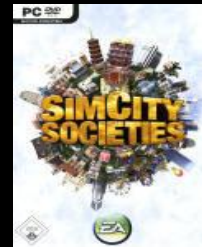
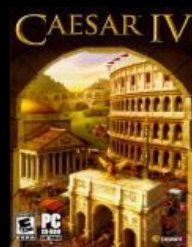
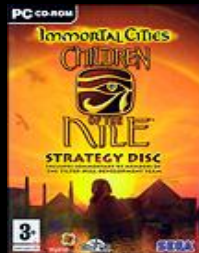
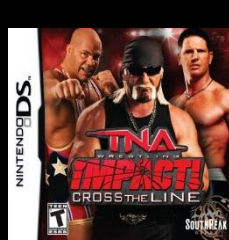
- Recording, Editing, Mixing
- Aesthetic and Technical Issues
- Audio Design and Technology
- Music, Sound, and Dialogue
- Real-Time Soundscapes

# Keith Zizza, IMGD Professor of Practice

Game Audio Consultant for recent projects:



Other games include:



# Audio in Game Development

Purpose of Game Audio

The Soundscape

Roles in Game Audio Design

Recording Sound, Music, and Dialogue

Making It Sound Good

Getting It in the Game

## **Purpose of Game Audio**



# Purpose of Game Audio

Game audio provides three basic functions:



- Provides Feedback to Player
- Adds to Immersion
- Adds Entertainment Value

# Purpose of Game Audio

Game audio can also provide a **UNIQUE** experience to each player.

Sound, Music, and Dialogue combine in various ways to help “sell” the game, and to suspend your disbelief.



*MLB 2K 11*

# The Soundscape



# The Soundscape

This total mix of music, sound, and / or dialogue is also known as the game's **SOUNDSCAPE**. The best soundscapes will be transparent to the player and not distract them from the game itself.



*Star Wars – The Old Republic*

# The Soundscape

## Components of the Game Soundscape

- Music
- Sound
- Dialogue



# The Soundscape

## Music

- Cinematics / In-game cutscenes
- Main Menu
- World / Environment based
- Character-based
- Milestone / Level up
- Ambient
- Battle / Challenge

# The Soundscape

## Sound

- Broadest scope of assets / total experience
- Simple to complex palette
- Cinematics / In-game cutscenes
- Ambience
- Objects
- Actions & Reactions
- *User Interface*

# The Soundscape

## Sound: User Interface

- Heads-up-display (HUD), indicator bars, lights, etc.
- Menu / in-game buttons and sliders
- *Any button, message, popup, or indicator sound*

# The Soundscape

## Dialogue

- Characters vs. Narrator(s)
- Cinematics / In-game cutscenes
- Wide variety of actors / actresses
- Foreign languages = Localization
- Dialogue as sound effects
- *Note:* Maintaining continuity
- *Note:* Most outsourced scheduling



## **Roles in Game Audio Design**

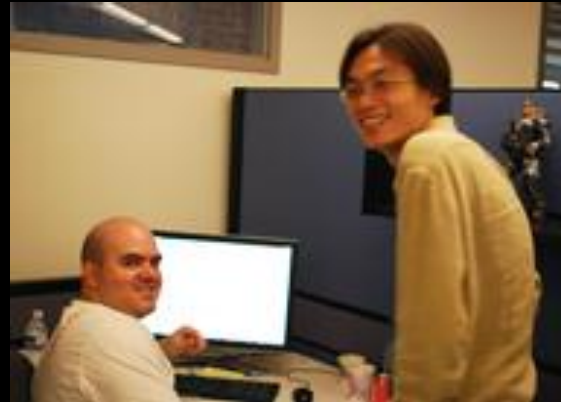
# Roles in Game Audio Design

Components of Game Company, in no particular order



# Roles in Game Audio Design

Often you'll see a large group working together in a common area: artists, animators, writers, producers, and designers.



From Tencent Boston Company Website, © 2009-2010 Tencent Boston

# Roles in Game Audio Design

But almost always, in a remote office, studio, or cave, lurks the audio designer. We need to shut out visual stimuli and other audible distractions.



It's worth noting, audio personnel need to get out more! It can sometimes be a challenge to stay integrated with the team, often having to work in a more isolated environment.

# Roles in Game Audio Design

Audio Director

Audio Manager

Audio Lead

Audio Editor

Voiceover (VO) Director

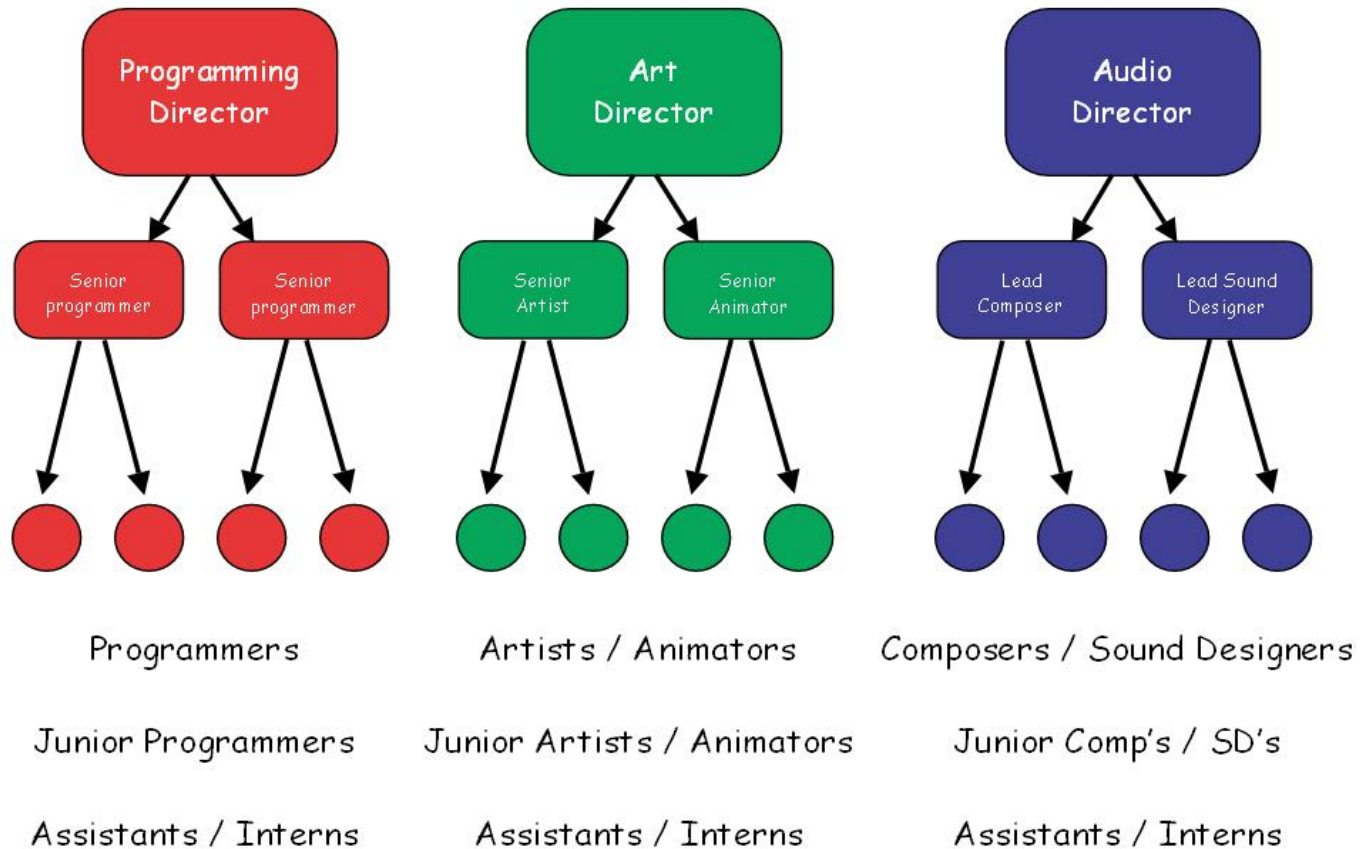
Composer

Sound Designer

Audio Programmer

Assistants and Interns

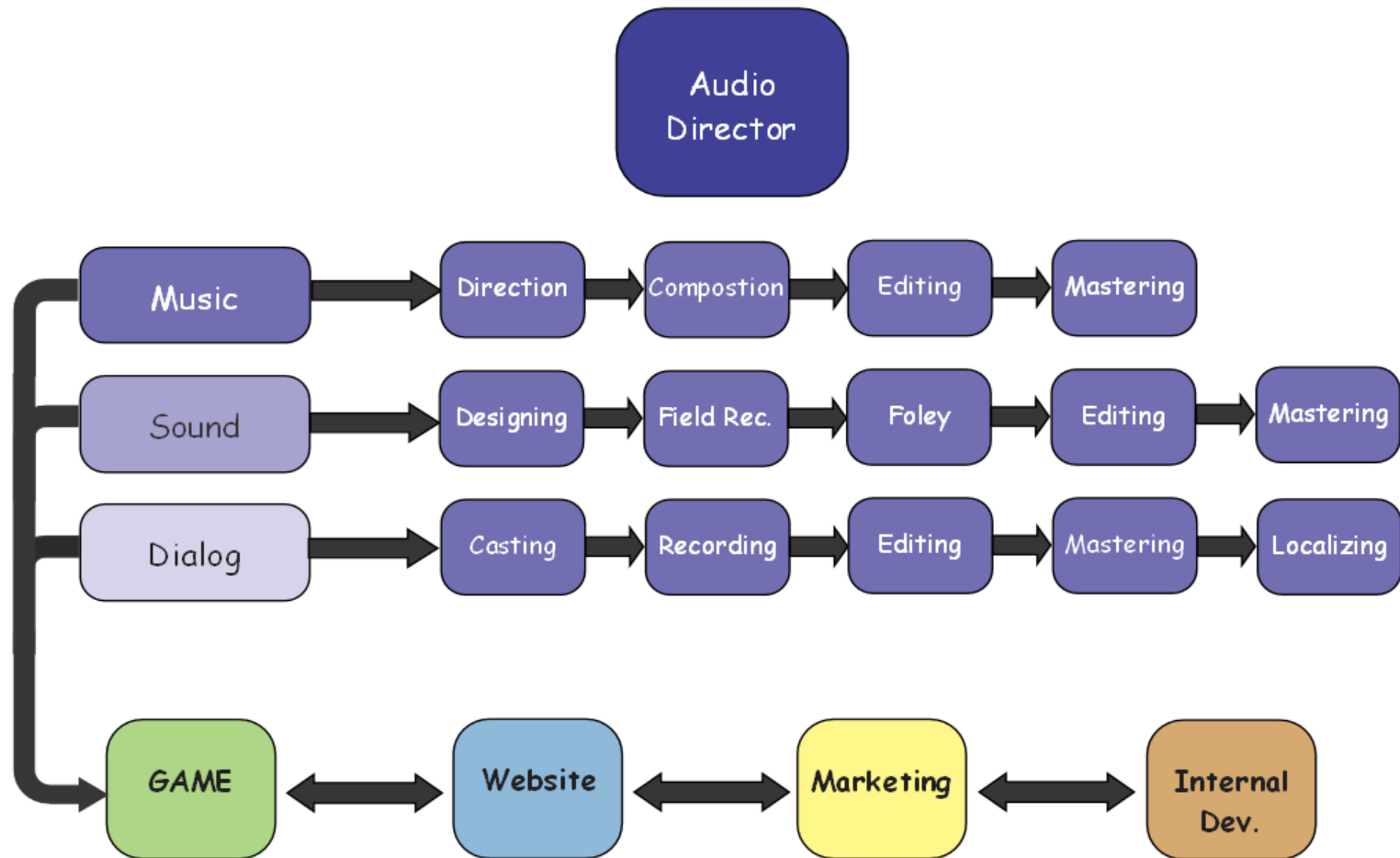
# Roles in Game Audio Design





# Roles in Game Audio Design

The Audio Director is accountable for:



Across MULTIPLE projects

# Roles in Game Audio Design

In a smaller company, you will probably handle most or ALL of these roles yourself!

Audio Director

Audio Manager

Audio Lead

Audio Editor

Voiceover (VO) Director

Composer

Sound Designer

Audio Programmer

Assistants and Interns

# Roles in Game Audio Design

Any of these roles (usually not the Audio Director) can be contracted out “Third Party”

**Audio Director**

**Audio Manager**

**Audio Lead**

**Audio Editor**

**Voiceover (VO) Director**

**Composer**

**Sound Designer**

**Audio Programmer**

**Assistants and Interns**

## **Recording Sound, Music, and Dialogue**

# Before You Begin

Start working on a solution to the audio design, with the programmers and designers.

Define a set of rules or a guide for the technology being used.

# Before You Begin

Need to set up ideas and concepts early on, working with designers and concept artists.

Starting early also gives us a better sense of the style, scope, and technical challenges of the project.

Reality dictates that starting early is often not the case, unless there is an in-house sound department. More often than not, the work is contracted out.



# Before You Begin

First ideas are usually overly optimistic (100,000 sound effects!)

Need to create an **Audio Asset List**.

Need to create a **Schedule with the Producer**.

# Before You Begin

copy of DC Sound Asset List.xlsx - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	<b>DEADLIEST CATCH</b>					Sound Asset List - FX				Green: yes / final						
2						Prepared by Keith Zizza				Light Green: for review	A	required - highest priority				
3										Yellow: placeholder	B	required - lower priority				
4										Red: no / missing	C	strongly recommended - lowest priority				
5						Updated 5/19/10				Orange: not working / redo		Loop				
6																
7	Status	FMOD	In P4	Tested	Sound FX Type / Description	Filename	Loop	Seconds	Priority	Notes						
38					thunder, heavy, 03	dc_amb_thunder_heavy_03.ogg			A							
39					thunder, heavy, 04	dc_amb_thunder_heavy_04.ogg			A							
40					wind, light	dc_amb_wind_light_01.ogg			A							
41					wind, medium	dc_amb_wind_med_01.ogg			A							
42					wind, heavy	dc_amb_wind_heavy_01.ogg			A							
43	Sound FX - misc															
44					cast pots - 01	dc_act_cast_pots_01.wav			A	large cage splash						
45					cast pots - 02	dc_act_cast_pots_02.wav			A							
46					cast pots - 03	dc_act_cast_pots_03.wav			B							
47					cast pots - 04	dc_act_cast_pots_04.wav			B							
48					cast pots - 05	dc_act_cast_pots_05.wav			B							
49					cast pots - 06	dc_act_cast_pots_06.wav			B							
50					cast pots - 07	dc_act_cast_pots_07.wav			B							
51					cast pots - 08	dc_act_cast_pots_08.wav			B							
52					cast pots - 09	dc_act_cast_pots_09.wav			B							
53					cast pots - 10	dc_act_cast_pots_10.wav			B							
54					retrieve pots - 01	dc_act_retrieve_pots_01.wav			A	pull cage rope						
55					retrieve pots - 02	dc_act_retrieve_pots_02.wav			A							
56					retrieve pots - 03	dc_act_retrieve_pots_03.wav			C							
57					retrieve pots - 04	dc_act_retrieve_pots_04.wav			C							
58					retrieve pots - 05	dc_act_retrieve_pots_05.wav			C							
59					ready hook - 01	dc_act_ready_hook_01.wav			C	artificial 'click' sound of winding back arm with hook						
60					ready hook - 02	dc_act_ready_hook_02.wav			C							
61					ready hook - 03	dc_act_ready_hook_03.wav			C							
62					ready hook - 04	dc_act_ready_hook_04.wav			C							
63					ready hook - 05	dc_act_ready_hook_05.wav			C							
64					toss hook - 01	dc_act_toss_hook_01.wav			B	quick swish of throwing the hook / rope						
65					toss hook - 02	dc_act_toss_hook_02.wav			B							
66					toss hook - 03	dc_act_toss_hook_03.wav			B							
67					toss hook - 04	dc_act_toss_hook_04.wav			B							
68					toss hook - 05	dc_act_toss_hook_05.wav			B							
69					toss hook - 06	dc_act_toss_hook_06.wav			B							
70					toss hook - 07	dc_act_toss_hook_07.wav			B							
71					cast line loop - 01	dc_act_line_loop_01.wav			B	line cast out, looping						
72					cast line end - 01	dc_act_line_end_01.wav			B	quick wind down/stop of line						
73					cast line end - 02	dc_act_line_end_02.wav			B							
74					cast line end - 03	dc_act_line_end_03.wav			B							
75					cast line end - 04	dc_act_line_end_04.wav			B							
76					cast line end - 05	dc_act_line_end_05.wav			B							
77					patch cable rotate - 01	dc_act_cable_rotate_01.wav				turning patch cable to fit on grid, whoosh effect						
78					patch cable rotate - 02	dc_act_cable_rotate_02.wav										
79					patch cable rotate - 03	dc_act_cable_rotate_03.wav										
80					patch cable rotate - 04	dc_act_cable_rotate_04.wav										
81					patch cable place - 01	dc_act_cable_place_01.wav				ka-chunk + clamping effect						
82					patch cable place - 02	dc_act_cable_place_02.wav										
83					patch cable place - 03	dc_act_cable_place_03.wav										
84					patch cable place - 04	dc_act_cable_place_04.wav										
85					patch cable place - 05	dc_act_cable_place_05.wav										
86					patch cable place - 06	dc_act_cable_place_06.wav										
87					patch cable place - 07	dc_act_cable_place_07.wav										
88					hit buoy - good	dc_act_hit_buoy_03.wav			B	TEMP sci-fi 'shinggg' sound fx						

Sound FX Music Dialogue Schedule

Example of a Audio Asset List

# Recording Sound Effects

## Remote (Field) Recording

Requires skill and patience – but can add originality, amazing depth





# Recording Sound Effects

## Foley Recording

Foley is the art of synchronizing sound effects to on-screen (or for us, in-game) actions.



Named after Jack Foley, the who created the technique for movies in the early 20<sup>th</sup> century.

# Recording Sound Effects

## Foley Recording

The “classical” definition of **Foley** is the art of synchronizing sound effects to film or video.



The person performing is in fact, a ***Foley Artist***.

# Recording Sound Effects

## Foley Recording

Sometimes we *have* to record Foley if we can't get the right sound effects to work. Here's an example of some Foley I had to do for a brick maker in SEGA's Children of The Nile™:

Sequence: Make Bricks

Variant: 3

Speed: 135 ms/frame



*Scoop mixture*

Frame 28  
make\_bricks\_1a



1a 2a 3a 4a



*Place in box*

Frame 5  
make\_bricks\_1b



1b 2b 3b 4b



*Drag board*

Frame 16  
make\_bricks\_1c



1c 2c 3c 4c



*Drop board*

Frame 23  
make\_bricks\_1d



1d 2d 3d 4d



# Recording Sound Effects

## Studio Recording / Custom Sound Design



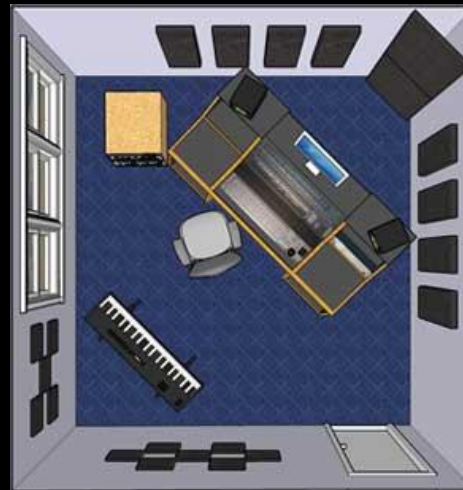
Vocal sound absorbers



Ceiling treatments



Total room solutions  
(sold as a package)



# Recording Sound Effects

## Off-the-Shelf Solutions



### Super Hard Drive Combo



Includes General HD, Ultimate SFX & Digieffects Hard Drives  
Get all 3 and Save \$5,000!

**LUCASFILM**  
Ltd



# Recording Sound Effects

## Off-the-Shelf Solutions

### Sound Effects Marketplaces / Subscriptions:



Downloadable Sound Effects Since 1997

**Westar Music**  
Professional Quality Production Music

**Now On**  
sounddogs.com

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Sounds are free to preview.  
Click [here](#) to create an account then purchase Hollywood feature film sound effects and production music tracks.  
To purchase [Log In](#) Select Sounds. Click "Order Selected", "Check Out", and then "Complete Order".

Select	Library	Preview	Description	Seconds	Max Cost
<input type="checkbox"/>	MP3		Feet Snow Crunchy Sandy Walk (MONO)	31	\$2.77
<input type="checkbox"/>	MP3		Feet Snow Crunchy Walk Uneven (MONO)	27	\$2.67
<input type="checkbox"/>	MP3		Crowd Museum MONA Lobby Medium Distant Footsteps	124	\$8.48
<input type="checkbox"/>	MP3		Crowd Museum Lobby Killing Whispers Footsteps Wood Squeak	121	\$8.44
<input type="checkbox"/>	MP3		Crowd Museum MONA Hall Light Footsteps Elevators Curious Kids	125	\$8.50
<input type="checkbox"/>	MP3		Shoe Wipe Carpet Clean Drag (MONO)	5	\$1.65
<input type="checkbox"/>	MP3		Shoe Wipe Carpet Clean Drag Rhythmic (MONO)	5	\$1.65
<input type="checkbox"/>	MP3		Shoe Wipe Carpet Clean Drag Kick x2 (MONO)	4	\$1.55
<input type="checkbox"/>	MP3		Feet Wood Walk Snappy Thin Stop Resume	21	\$3.30
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<input type="checkbox"/>	MP3		Crowd Museum MONA Hall Large Miling Footsteps Loop	231	\$8.55
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<input type="checkbox"/>	MP3		Feet Snow Walk Heavy Hard (MONO)	23	\$2.55
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Wood Steady Slow Deep	60	\$4.46
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Wood Steady Slow Deep Heavy Loop (MONO)	46	\$3.11
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Wood Steady Slow Steady (MONO)	81	\$3.37
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Concrete Steady	45	\$4.10
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Concrete Steady Slow	36	\$3.85
<input type="checkbox"/>	MP3		Roller Skates Hand Held Footsteps Wood Steady Slow	42	\$4.02

Buy a single sound, or subscribe annually to download as many sounds as you want, under the license terms.

# Recording Music

## Live Recording

Commercial Recording Studios are used when we need to capture live performances, and have access to the best equipment and acoustic space. The only disadvantage is the cost, and keeping an eye on the studio clock.



Ron Jones conducting in a commercial studio

# Recording Music

## Studio Recording

Personal Project Studios are in greater use today, now that many recording tools are more affordable and can be “virtualized” in the computer.

A great advantage here is that the composer has 100% control over the entire recording process, and session time. And there is no monetary overhead (aside from having to purchase your own equipment).





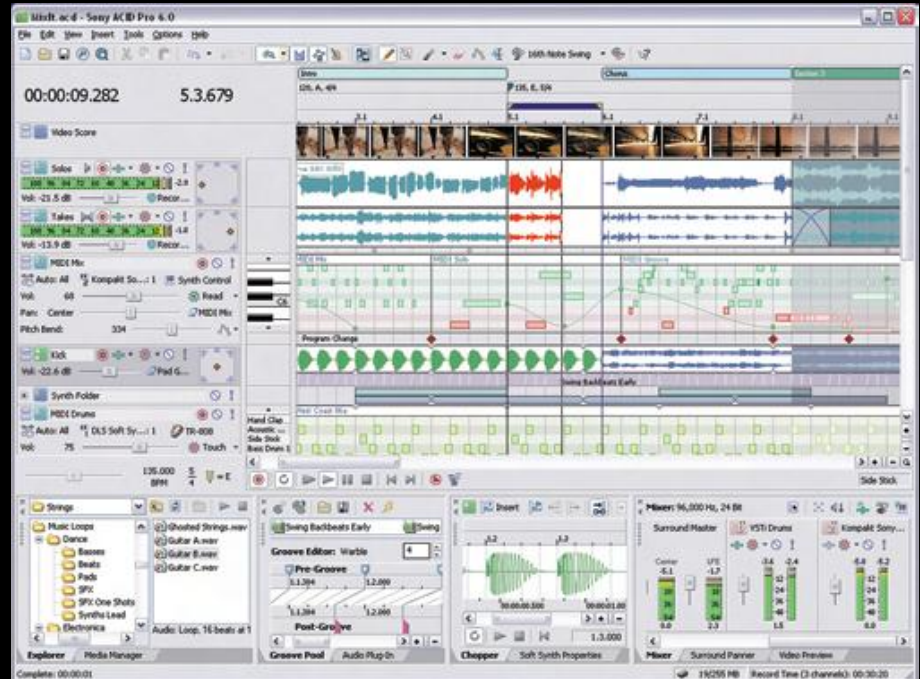
# Recording Music

## Studio Recording

Other Music Creation Methods besides live recording include MIDI sequencing, virtual instruments, samplers, and looping software, such as Sony's Acid (below).



*Alesis iPad Audio Dock  
running GarageBand*



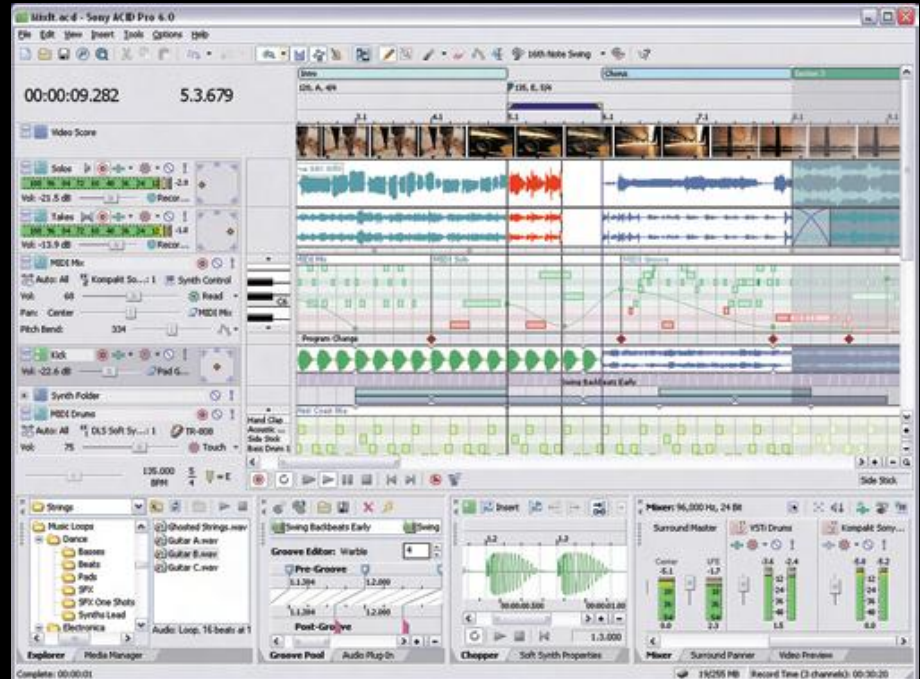
# Recording Music

## Studio Recording

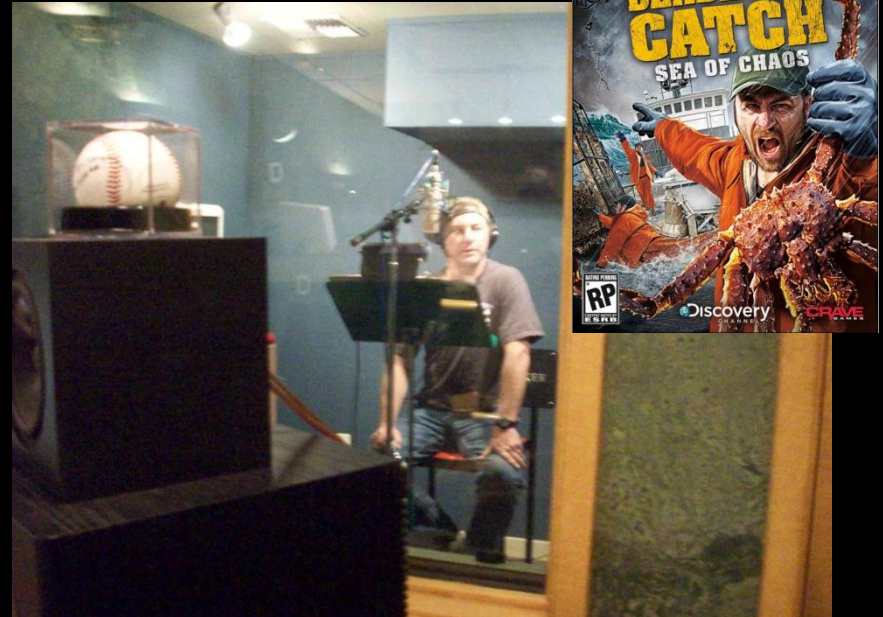
Other Music Creation Methods besides live recording include MIDI sequencing, virtual instruments, samplers, and looping software, such as Sony's Acid (below).



*The Wallander Brass Virtual Instrument Environment*



# Recording Dialogue



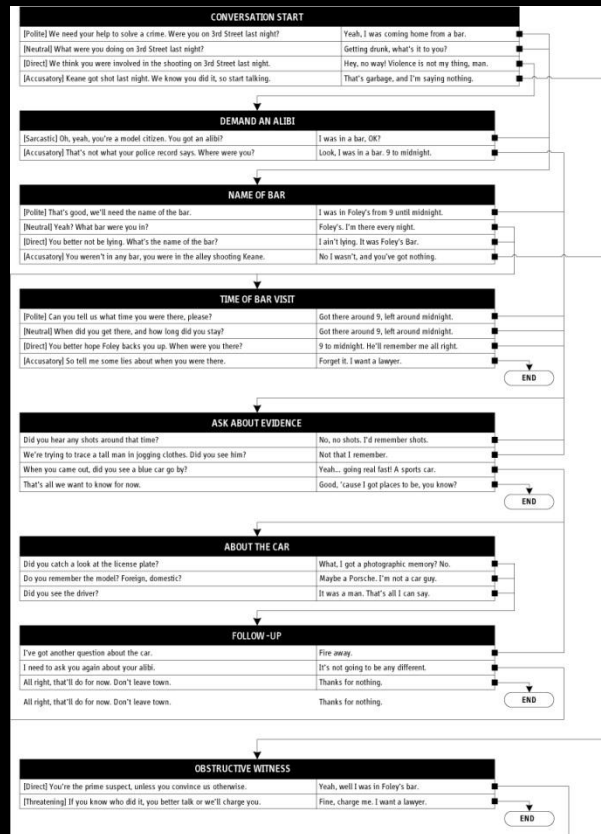
Andy Hillstrand at *Bad Animals* Recording Studio in Seattle

The dialogue is recorded with the VO director / coach, voice talent, and recording engineer. Providing encouragement to the voice talent and having a sense of humor are a must!



# Recording Dialogue

Scripts are normally read in a linear fashion, but in the case of Interactive or Adaptive Dialogue, scripts can be printed in a “flowchart”-style format for reading through possible dialogue paths.



Lani Minella of *AudioGodz* casting services

# Recording Dialogue

Above all you have to try to **stay on schedule**, **receive advice and criticism** from people in the voice session, and also **be confident** in your abilities to manage the process.

There will be a lot of **opinions** offered, but as the VO Director / Coach, it's up to you to **take charge** and decide what the best approaches will be for the voice talent.

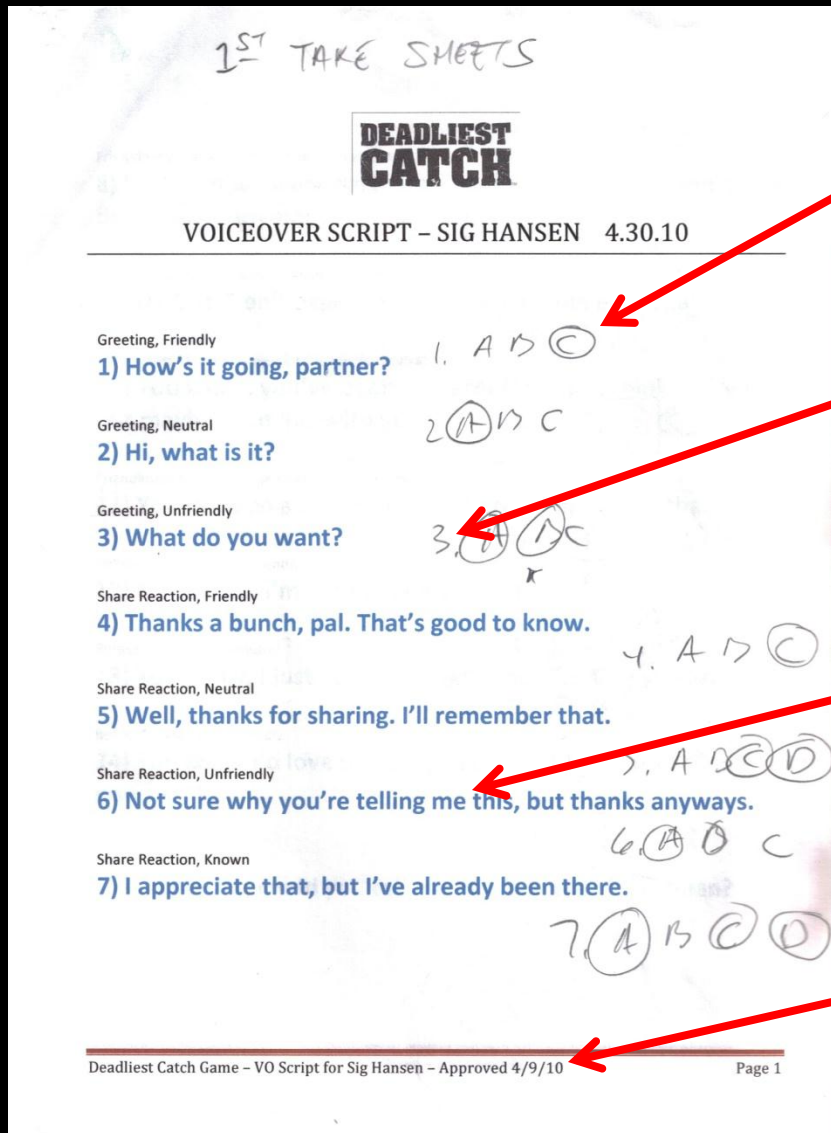
Seated behind Keith:

- 4 Executives from Discovery Channel
- 3 Executives from the game publisher
- Studio Manager and Recording Engineer
- Temperature in room: about 80 degrees
- Opinions: MANY
- Stress level: What do YOU think!?!? ☺



Keith with Johnathan Hillstrand, recording VO  
For Deadliest Catch: Sea of Chaos

# Recording Dialogue



The script is marked up with the various “good” takes (A, B, C, etc) for reference later.

Takes marked “2”, “3”, and so on are usually returned to the audio editor as “Take 2.wav”, “Take 3.wav”.

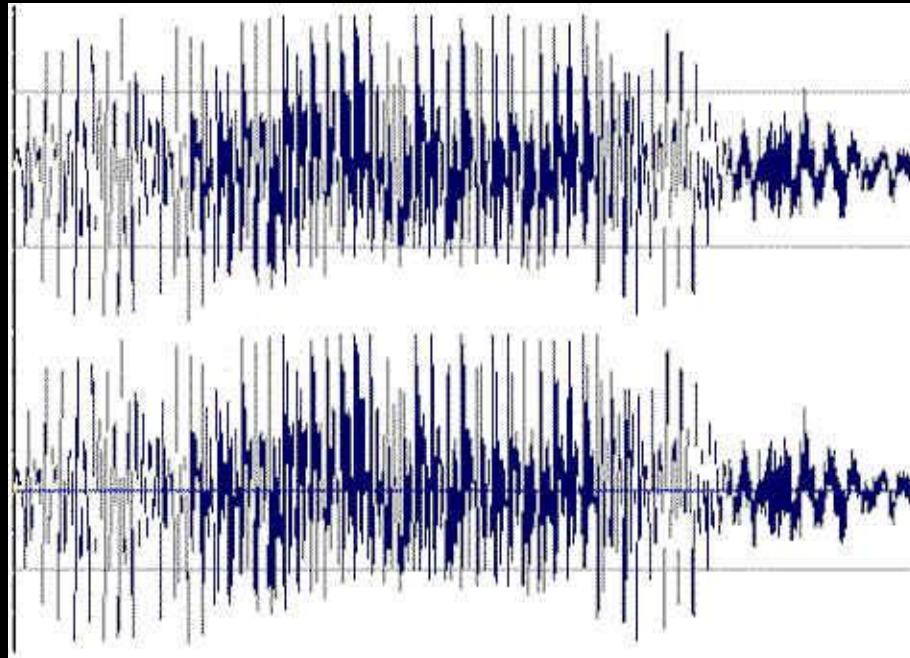
Font size is **LARGE** and pages are formatted, so everyone can read the script clearly. Plus, there's lots of space for writing notes.

Also good to have something on the script that says “approved”, as there could be several versions available. Only **one** is the final version!

**Making it Sound Good**

# Making It Sound Good

When working with audio files, we are not just limited to the raw material itself.

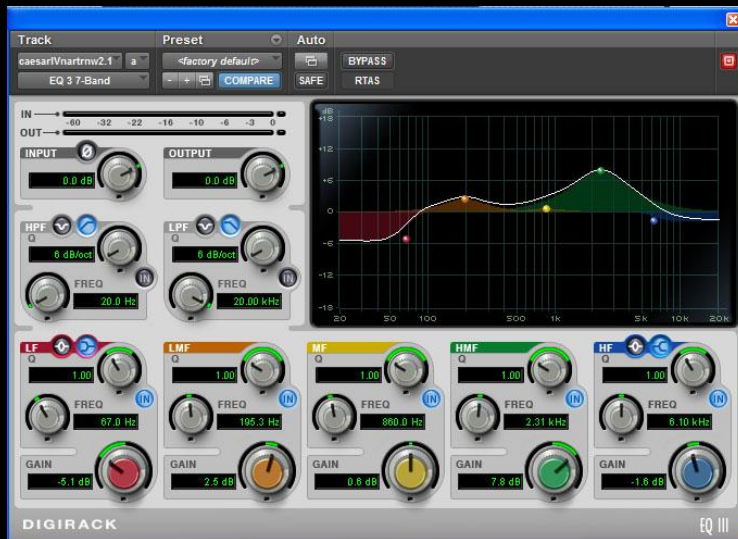


We can manipulate the audio in various ways, especially in the application of sound effects.



# Making It Sound Good

Once in the computer, we can apply various adjustments, such as dynamics, frequency balancing (“EQ”) and special effects.

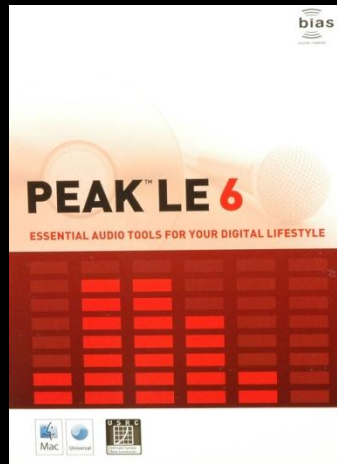


As a whole, these techniques are often called “DSP”, or Digital Signal Processing.

# Making It Sound Good

## Audio Editors

Audio Editing software usually implies that we're working with a two-channel (stereo) editing system.

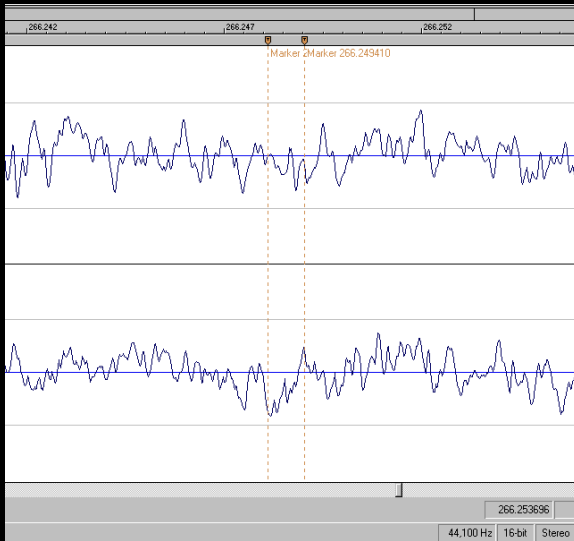


Here we can get very in-depth and “surgical” with our individual sound files, all the way down to the sample level.

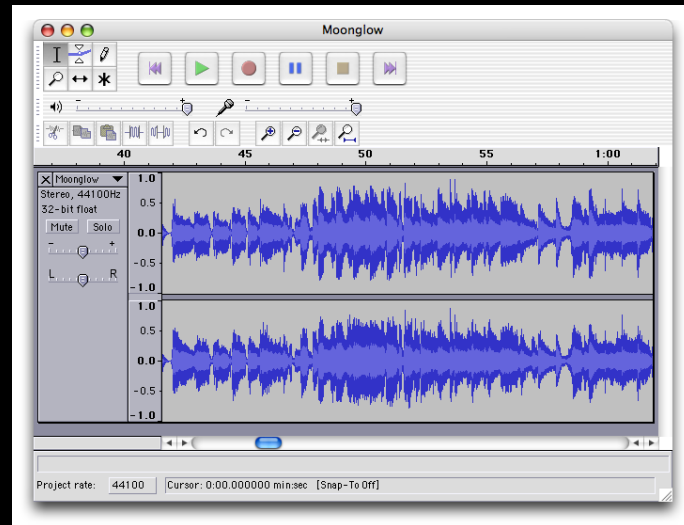
# Making It Sound Good

## Audio Editors

Audio Editing software usually implies that we're working with a **two-channel** (stereo) editing system.



*Sound Forge*



*Audacity*

Here we can get very in-depth and “surgical” with our individual sound files, all the way down to the sample level.



# Making It Sound Good

## Multitrack Editors

When dealing with **multiple files** at once, mixing, and syncing to video (among other tasks), Multitrack Editors are essential to audio production.



## Pro Tools Editing Software

# Making It Sound Good

## Multitrack Editors

When dealing with **multiple files** at once, mixing, and syncing to video (among other tasks), Multitrack Editors are essential to audio production.

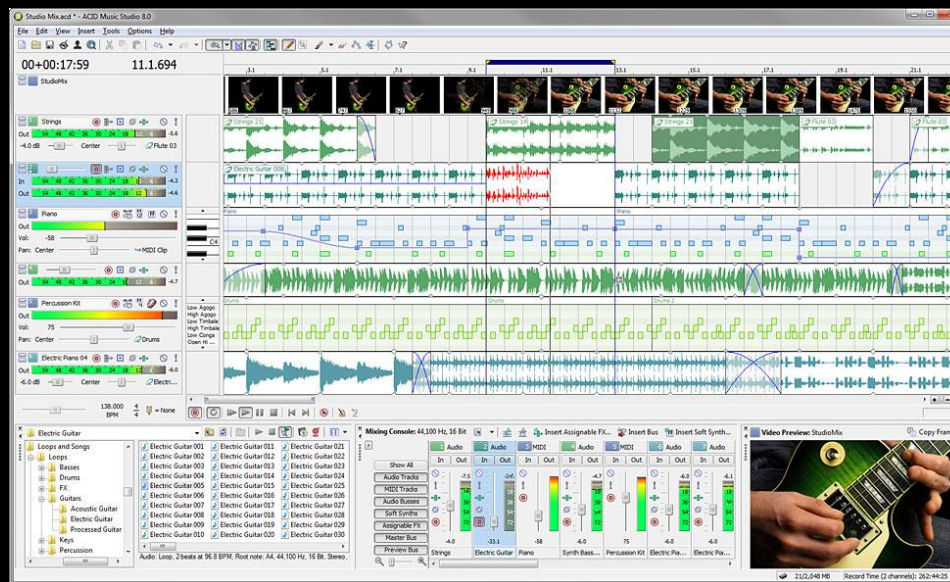


*Garageband for iPad*

# Making It Sound Good

## Looping Software

Sample-based file creation can be accomplished with Looping Software, which is a **specialized version** of Multitrack Editing Software.



Drum Loop



Backing Loop



Result

*Sample source: Zero-G Urban Underground, leased to Keith Zizza, Course Instructor.*

Used mostly for quick music production from existing elements (drums, bass, guitar, keyboards, vocals, etc). Pitch and time can be manipulated to join all loops together seamlessly.

# Making It Sound Good

## Sequencers

What is also known as Tracking Software, Sequencers are focused on pure **music production** using a variety of input sources (from an audio interface).



*Apple Logic Express and Logic Studio*

# Making It Sound Good

## Plug-ins

Plug-ins are used as auxiliary programs in our “host” application (Pro Tools, etc) when we want to apply special effects, EQ, or dynamics processing to a particular sound or audio track.



*Waves Platinum Bundle Plug-in Family*



# Making It Sound Good

## Plug-ins

A large variety of plug-ins (usually virtual **effects**, or **DSP**, are necessary for adding variety, interest, and “pop” to sounds in game development.

Creature Vocal – before plug-in



Creature Vocal – after plug-in



Witch Laughter – before plug-in



Witch Laughter – after plug-in



# Making It Sound Good

## Plug-ins

Often you can chain plug-ins one after another, in real time, to cascade multiple types of effects onto a single audio clip.



Tutorial Voice – before plug-ins



Adding Doubler plug-in



Doubler + Pitch plug-in



Doubler + Pitch + Reverb plug-in

**Getting It in the Game**

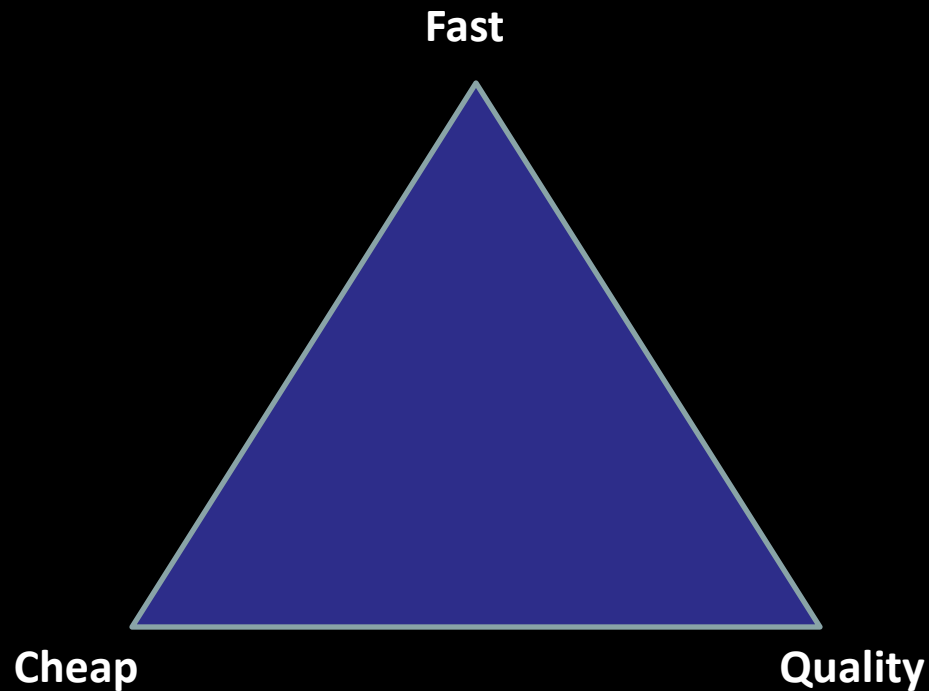


# Game Audio Resources

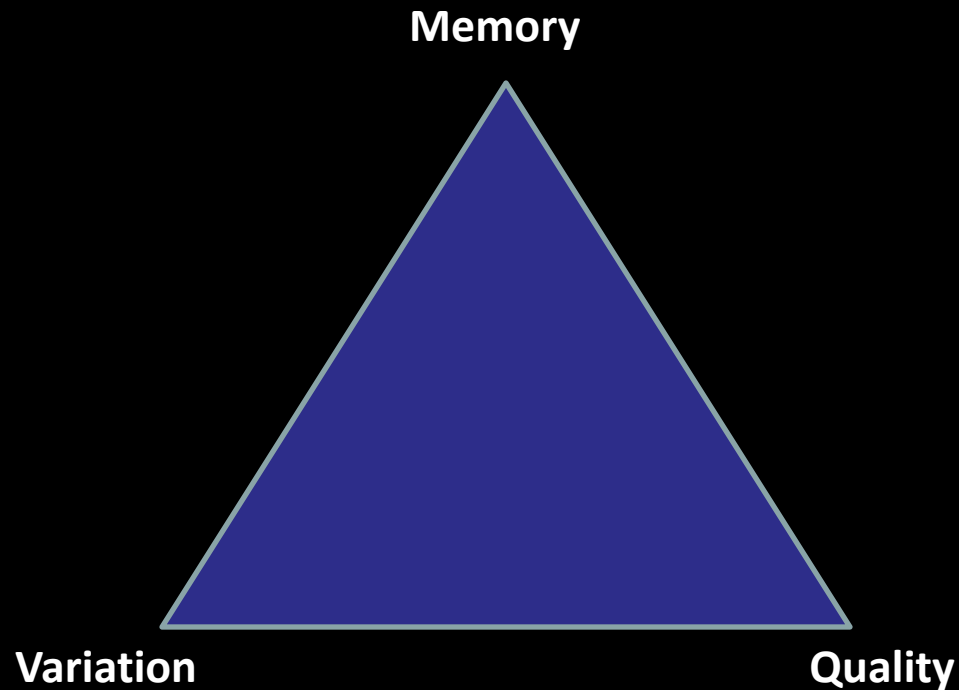
Game Audio Professionals are always competing for  
console / PC **resources**:

- **Memory**
- **CPU**
- **Number of Channels**
- **Real time Effects**

# **In Game Development (or any business): The Triangle of Compromise**



# Game Audio Resources: The Triangle of Compromise (or “*The Triangle of Pain*”)



# Getting It in the Game: Integration

## Scripting Systems

Scripts (high-level code such as XML, C#, or a custom language) can be used to call up and manipulate sounds and special effects in a game.

# Getting It in the Game: Integration

## Scripting Systems

These can be either typed from scratch or generated automatically from a database or special software application.

```
new AudioDescription(AudioNonLooping)  
{  
  volume = 1.0;  
  isLooping= false;  
  is3D = false;  
  type = $GuiAudioType;  
};
```

```
new AudioDescription(AudioLooping)  
{  
  volume = 1.0;  
  isLooping= true;  
  is3D = false;  
  type = $GuiAudioType;  
};
```

***Torque audio script segment***

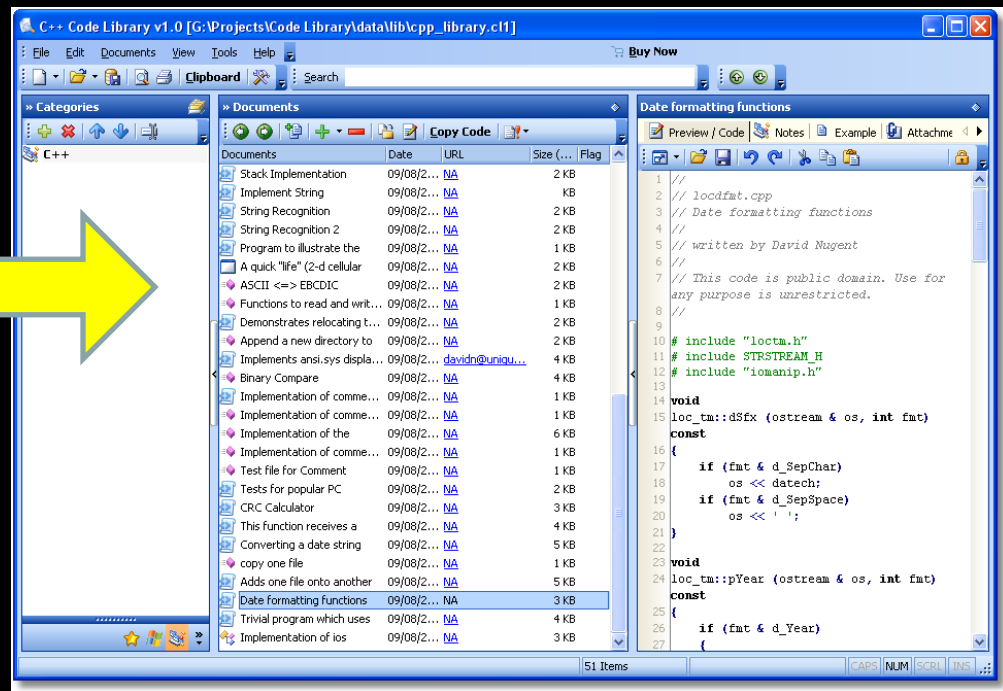
# Getting It in the Game: Integration

## Scripting Systems

The programmer then simply drops the script into the existing code, saving a considerable amount of time.

```
new  
AudioDescription(AudioNonLooping)  
{  
    volume = 1.0;  
    isLooping= false;  
    is3D = false;  
    type = $GuiAudioType;  
};
```

```
new AudioDescription(AudioLooping)  
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};
```



# Scripting Systems





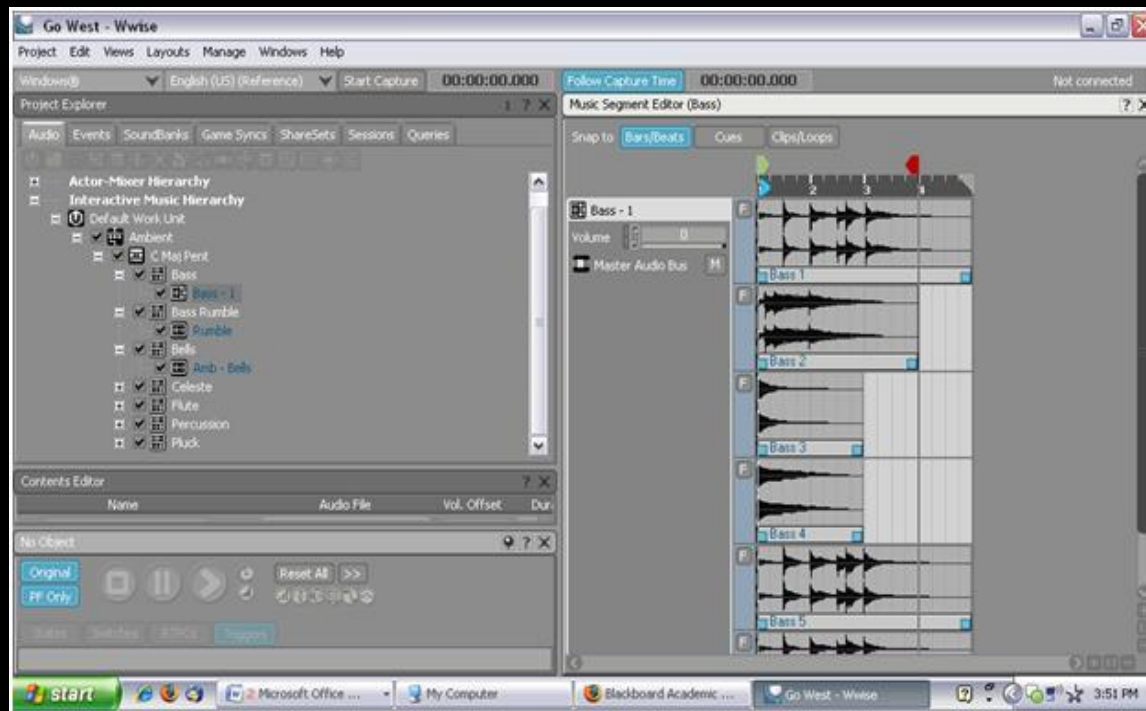
# Scripting Systems



# Getting It in the Game: Integration

## Audio Engines

Often we require more than just exported scripts.

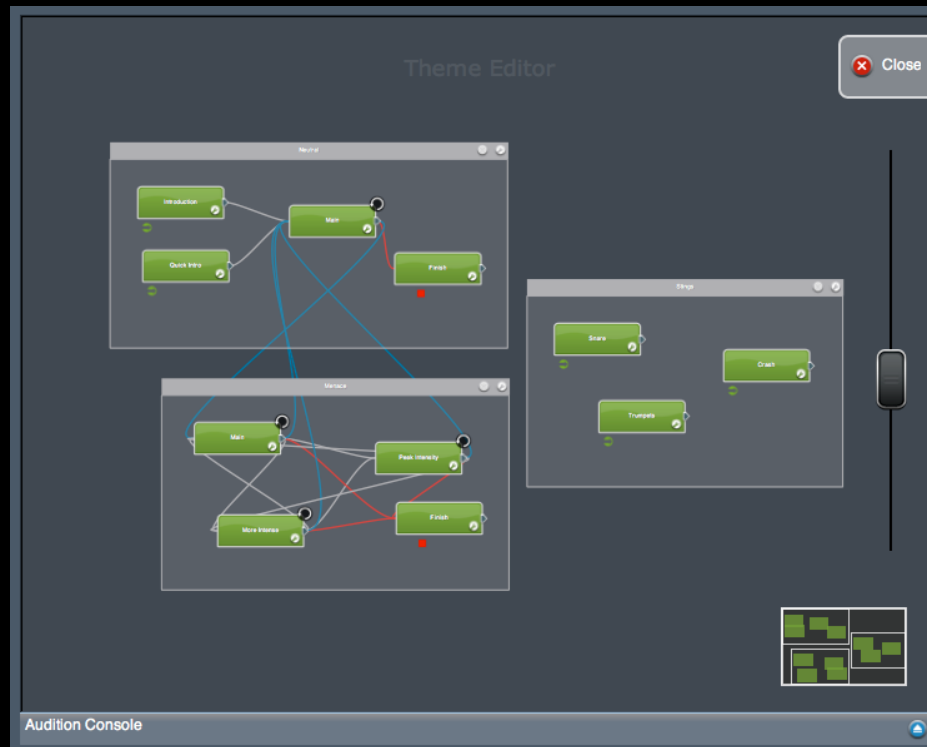


**Audio Engines** allow the audio designer and the programmer to work even more efficiently together.

# Getting It in the Game: Integration

## Audio Engines

The audio designer focuses on the creative and production work.



The programmer then uses “hooks” and other tools in the audio engine to allow the soundscape to flourish in the game.

# Getting It in the Game: Integration

Audio Engines used on the latest games:



**Miles / RAD Game Tools** – also includes video production tools



**Microsoft XACT** – exclusively for Xbox Development



**Audiokinetic Wwise** - WaveWorks Interactive Sound Engine



**Firelight Technologies** – FMOD Sound System

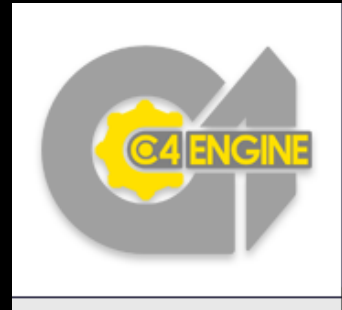
## Getting It in the Game: Integration

There are other engines with audio tools, but these are “Turnkey” solutions (level design, graphics, animation, etc).



  
freakygaming.com

**Unreal Engine –**  
*Unreal Technologies*



**C4 Engine –** *Terathon*

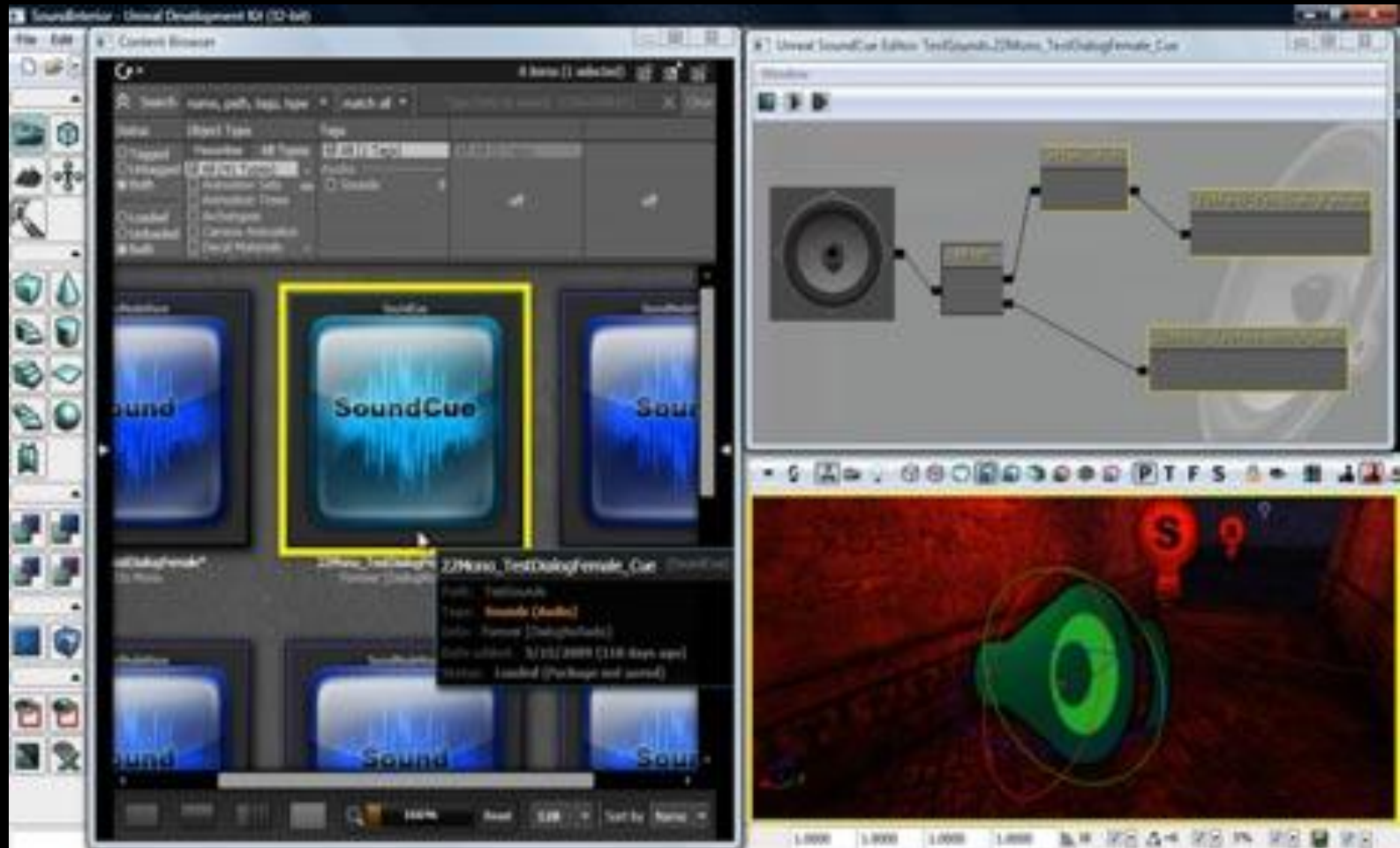


**Torque Engine –**  
*InstantAction*



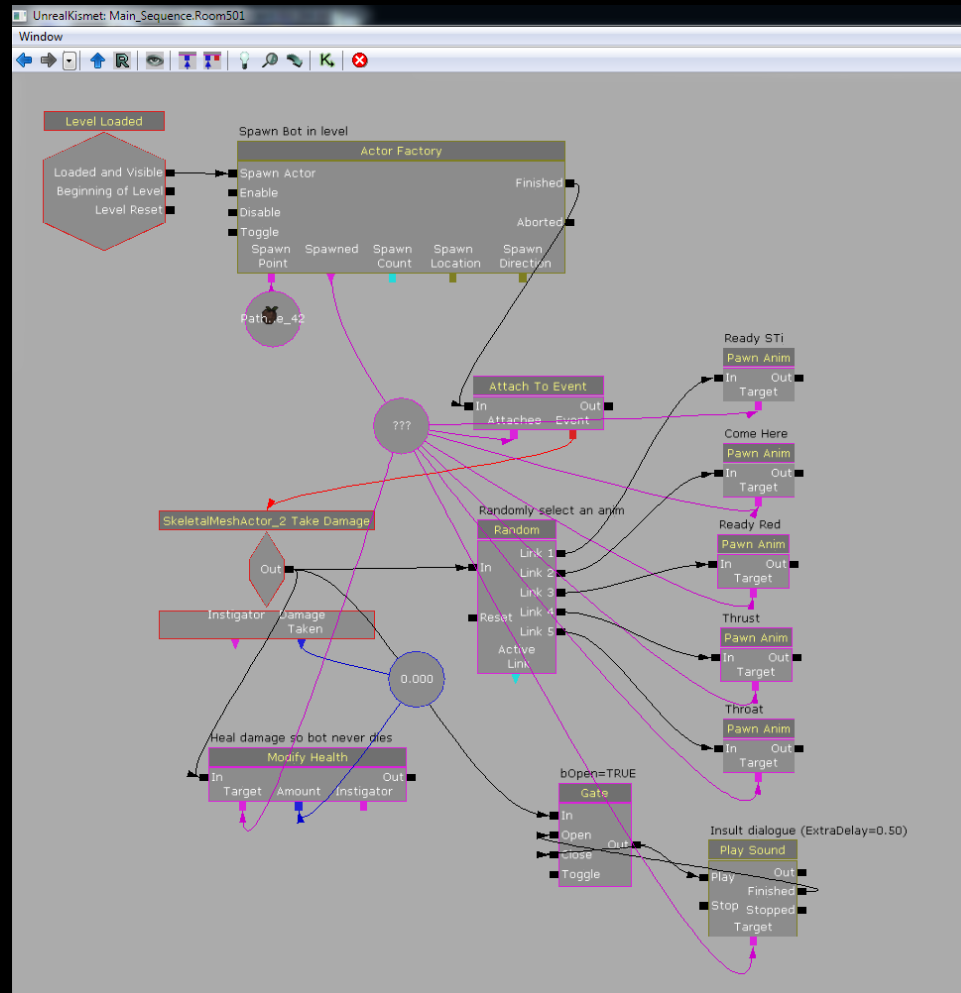
**Unity 3D Engine –**  
*Unity Technologies*

# Getting It in the Game: Unreal Development Kit (UDK)





# Getting It in the Game: Unreal Development Kit (UDK)



*Kismet™ Visual Programming: adding logic, behavior, DSP, and mixing.*