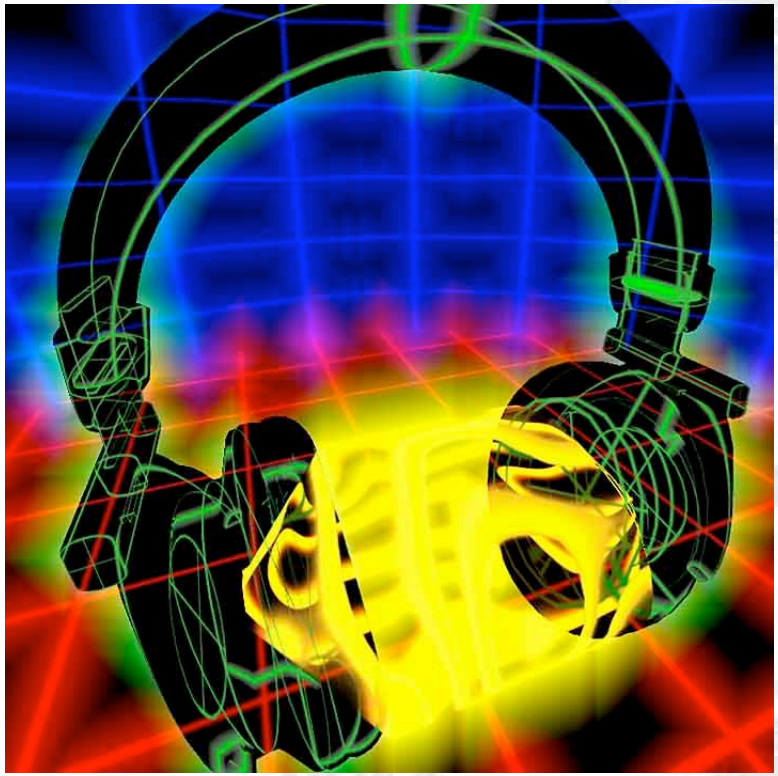
Video Game Audio

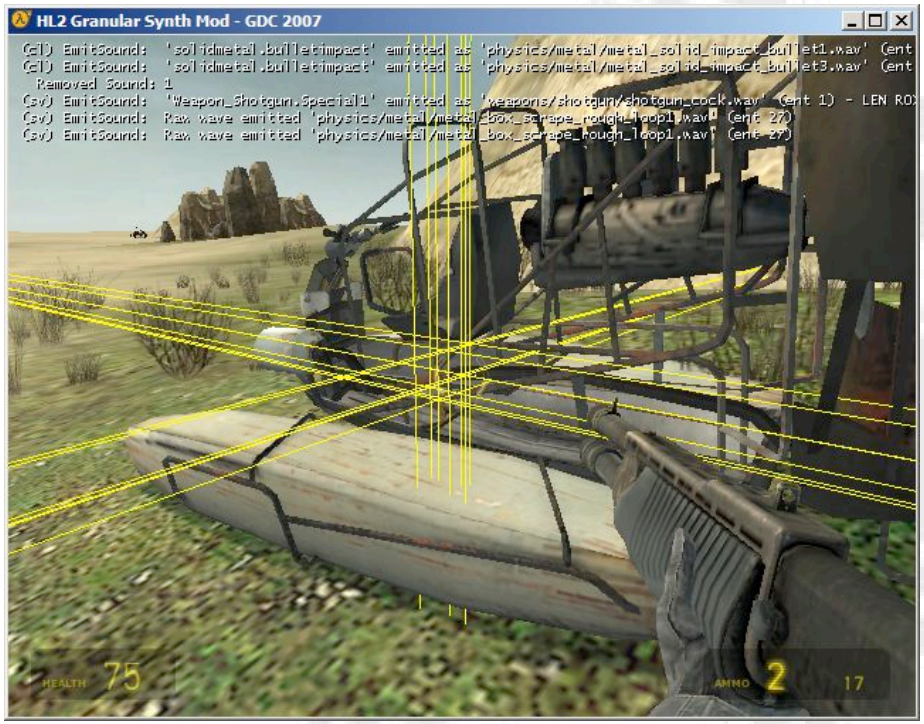
Leonard J. Paul
Vancouver Film School

VideoGameAudio.com



Overview

- Introduction
- Directions in game audio
- Lessons learned
- Questions



Introduction

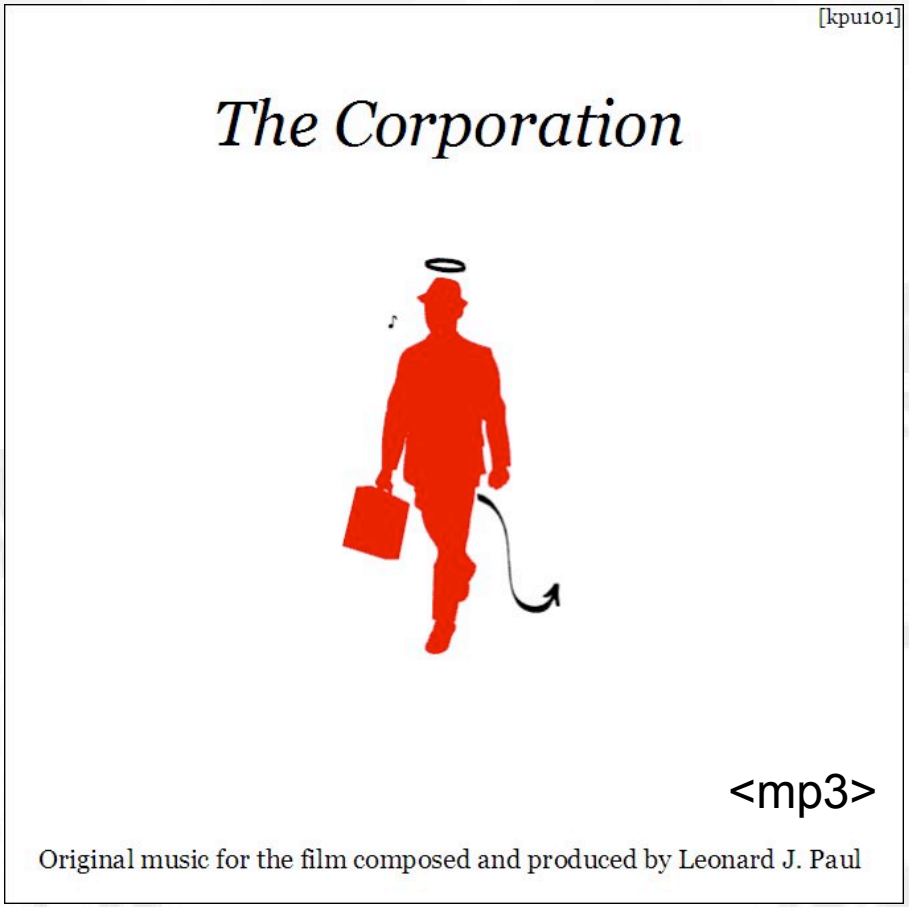
- 1994 – *NBA Live '95* - Sega Genesis (EA)

Introduction

- 2005 – Surrey Remixx Project (Techlab)

Introduction

- 2003 – Soundtrack for the film *The Corporation*



Introduction

- 2007 – *Monster Lab* (Wii / NDS)

Introduction

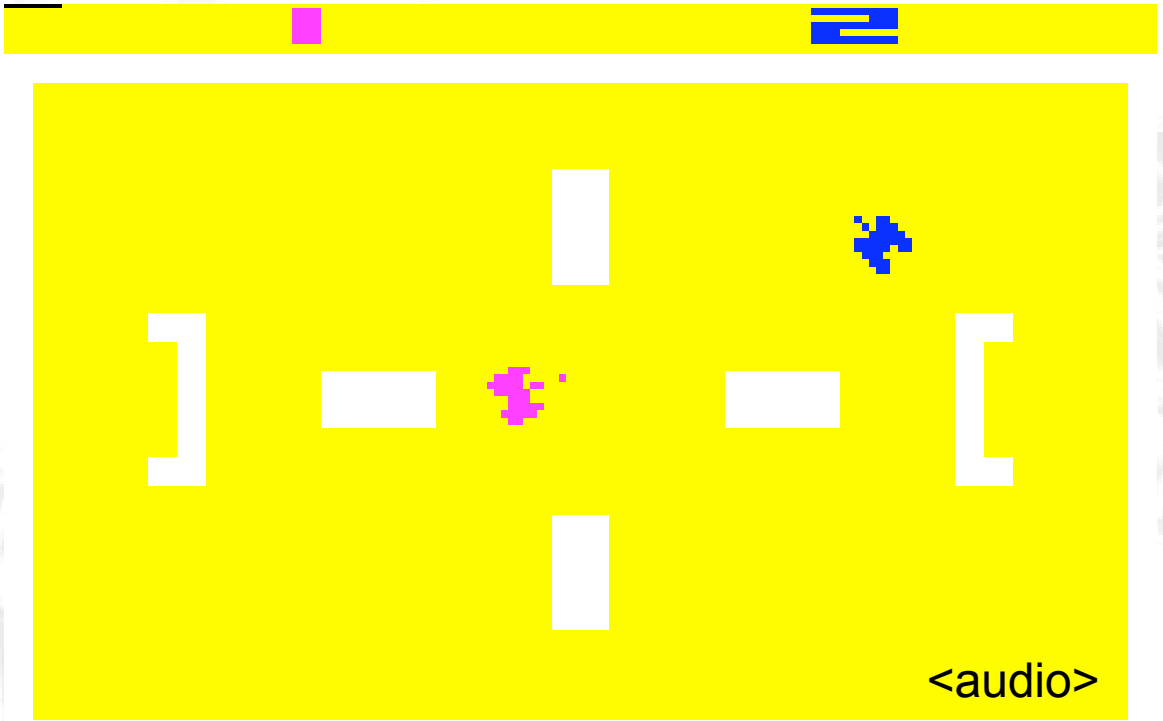
- 2008 – *Facebreaker* – X360, PS3 (EA)

Introduction

- Electronic Arts Canada
- World's largest game studio–1500 employees

Game Audio

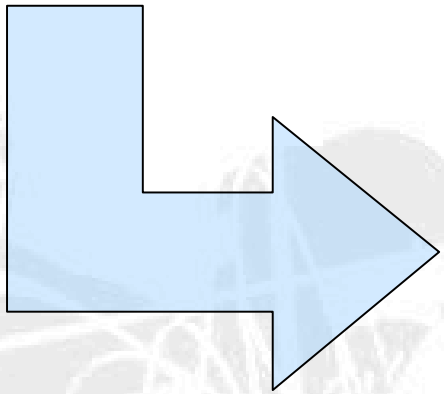
- 1977 – Atari VCS / 2600
  - 1 mhz processor, 16 colours...



Combat (1977 Atari)

Game Audio

- *Combat* =
  2*KB* ROM!
  2 Voices



```
78 d8 a2 ff 9a a2 5d 20  bd f5 a9 10 8d 83 02 85
88 20 a3 f1 20 32 f0 20  57 f1 20 72 f5 20 da f2
20 44 f4 20 14 f2 20 a9  f2 20 f2 f1 20 54 f0 4c
14 f0 e6 86 85 2b a9 02  85 02 85 01 85 02 85 02
85 02 85 00 85 02 85 02  a9 00 85 02 85 00 a9 2b
8d 96 02 60 a9 20 85 b4  85 02 85 2a ad 84 02 d0
fb 85 02 85 2c 85 01 ba  86 d3 a9 02 85 0a a6 dc
85 02 ca d0 fb a5 dc c9  0e f0 52 a2 05 a9 00 85
de 85 df 85 02 a5 de 85  0e a4 e2 b9 c5 f5 29 f0
85 de a4 e0 b9 c5 f5 29  0f 05 de 85 de a5 df 85
0e a4 e3 b9 c5 f5 29 f0  85 df a4 e1 b9 c5 f5 25
87 85 02 05 df 85 df a5  de 85 0e ca 30 0f e6 e0
e6 e2 e6 e1 e6 e3 a5 df  85 0e 4c 83 f0 a9 00 85
0e 85 02 a9 05 85 0a a5  d6 85 06 a5 d7 85 07 a2
1e 9a 38 a5 a4 e5 b4 29  fe aa 29 f0 f0 04 a9 00
f0 02 b5 bd 85 02 85 1b  a5 a7 45 b4 29 fe 08 a5
a6 45 b4 29 fe 08 a5 b4  10 02 49 f8 c9 20 90 04
4a 4a 4a a8 a5 a5 38 e5  b4 e6 b4 ea 09 01 aa 29
f0 f0 04 a9 00 f0 02 b5  bd 24 82 85 1c 30 0c b1
b5 85 0d b1 b7 85 0e b1  b9 85 0f e6 b4 a5 b4 49
ec d0 9c a6 d3 9a 85 1d  85 1e 85 1b 85 1c 85 1b
85 0d 85 0e 85 0f 60 ad  82 02 4a b0 13 a9 0f 85
87 a9 ff 85 88 a9 80 85  dd a2 e6 20 bd f5 f0 60
a0 02 a5 dd 25 88 c9 f0  90 08 a5 86 29 30 d0 02
a0 0e 84 dc a5 86 29 3f  d0 08 85 89 e6 dd d0 02
85 88 ad 82 02 29 02 f0  04 85 89 d0 54 24 89 30
50 e6 80 a2 df 20 bd f5  a9 ff 85 89 a4 80 b9 d8
f7 85 a3 49 ff d0 04 a2  dd d0 ea a5 81 f8 18 69
01 85 81 85 a1 d8 24 a3  10 06 e6 85 50 02 e6 85
20 25 f5 a9 32 85 a5 a9  86 85 a4 24 a3 30 12 85
a5 85 11 a9 08 85 96 a9  20 85 20 85 21 85 02 85
2a 60 a2 01 b5 a1 29 0f  85 d2 0a 0a 18 65 d2 95
e0 b5 a1 29 f0 4a 4a 85  d2 4a 4a 18 65 d2 95 e2
ca 10 e1 60 24 83 50 04  a9 30 10 02 a9 20 85 b1
a2 03 20 54 f2 ca 20 54  f2 ca b5 8d 29 08 4a 4a
86 d1 18 65 d1 a8 b9 a8  00 38 30 01 18 2a 99 a8
00 90 0d b5 ac 29 01 0a  0a 0a 0a 85 b1 20 54 f2
ca f0 d7 60 f6 ac b5 95  29 0f 18 65 b1 a8 b9 f7
f5 85 b0 24 82 70 13 b5  95 38 e9 02 29 03 d0 0a
b5 ac 29 03 d0 04 a9 08  85 b0 a5 b0 95 20 29 0f
38 e9 08 85 d4 18 75 a4  24 a3 30 04 e0 02 b0 10
c9 db b0 04 c9 25 b0 08  a9 d9 24 d4 30 02 a9 28
95 a4 e0 02 b0 02 95 25  60 a9 01 25 86 aa b5 95
95 0b 29 0f a8 24 83 10  02 94 97 8a 49 0e aa 98
0a 0a 0a c9 3f 18 30 03  38 49 47 a8 b1 bb 95 bd
90 02 88 88 c8 ca ca 10  f3 60 a5 8a 38 e9 02 90
2b 85 8a c9 02 90 24 29  01 aa f6 95 b5 d8 95 d6
a5 8a c9 f7 90 03 20 08  f5 a5 8a 10 0e 4a 4a 4a
95 19 a9 08 95 15 bd fe  f7 95 17 60 a2 01 ad 82
02 85 d5 ad 80 02 24 88  30 02 a9 ff 49 ff 29 0f
85 d2 a4 85 b9 0f f7 18  65 d2 a8 b9 12 f7 29 0f
85 d1 f0 04 d5 91 d0 04  d6 93 d0 0d 95 91 a9 0f
95 93 a5 d1 18 75 95 95  95 f6 8d 30 1e b9 12 f7
4a 4a 4a 4a 24 d5 30 23  95 8b 0a a8 b9 37 f6 95
a8 c8 b9 37 f6 95 aa a9  f0 95 8d 20 80 f3 ad 80
02 4a 4a 4a 4a 06 d5 ca  f0 9c 60 38 e5 85 10 d8
a5 a3 30 08 29 01 f0 04  a5 db 95 d6 b5 99 f0 27
b5 d8 95 d6 b5 99 c9 07  90 14 24 d5 10 04 c9 1c
90 0c c9 30 90 1f c9 37  b0 21 24 83 50 1d a9 00
95 99 a9 ff 95 28 60 24  88 10 04 b5 3c 10 37 20
10 f4 4c ae f3 20 10 f4  4c de f3 b5 9f f0 0a 20
10 f4 a9 30 95 99 4c de  f3 b5 99 20 00 f3 a5 86
29 03 f0 0c 24 84 70 0a  24 82 50 04 29 01 d0 02
d6 99 a9 00 f0 be a9 3f  95 99 38 b5 a4 e9 06 95
```

```
a6 b5 95 95 97 a9 1f 95  9b a9 00 95 9d 4c cb f3
b5 9f f0 0d a9 04 95 15  a9 07 95 19 b5 9b 95 17
60 a4 85 b9 33 f7 25 88  95 19 b9 36 f7 95 15 18
a9 00 88 30 04 69 0c 10  f9 75 8b a8 8a 0a 79 39
f7 95 17 60 a2 01 b5 30  10 2c 24 84 50 06 b5 9b
c9 1f f0 22 f6 95 f6 97  f8 b5 a1 18 69 01 95 a1
d8 8a 18 69 fd 85 8a a9  ff 85 28 85 29 a9 00 95
19 85 99 85 9a 60 24 a3  10 03 4c 01 f5 b5 9f f0
0a c9 04 f6 9f 90 04 a9  00 95 9f b5 34 30 07 a9
00 95 9d 4c d6 f4 24 82  50 36 b5 9d d0 19 f6 9f
d6 9b b5 97 95 b2 49 ff  95 97 f6 97 b5 97 29 03
d0 02 f6 97 4c d4 f4 c9  01 f0 0b c9 03 90 15 d0
13 b5 b2 4c c8 f4 b5 97  18 69 08 95 97 4c d4 f4
a9 01 95 99 f6 9d b5 32  30 04 a5 37 10 09 a5 8a
c9 02 90 09 20 08 f5 a9  03 95 e4 d0 14 d6 e4 30
06 b5 8b f0 0c d0 02 f6  95 b5 95 18 69 08 20 0f
f5 ca 30 03 4c 46 f4 60  8a 49 01 a8 b9 97 00 29
0f a8 b9 27 f6 20 7c f2  a9 00 95 a8 95 aa 95 8d
b5 d8 95 d6 60 a6 85 bd  c6 f7 85 bb bd c9 f7 85
bc a5 a3 4a 4a 29 03 aa  a5 a3 10 0a 29 08 f0 04
a2 03 10 04 a9 80 85 82  a5 a3 0a 0a 24 a3 30 06
85 02 85 84 29 80 85 83  a9 f7 85 b6 85 b8 85 ba
bd cc f7 85 10 85 b5 bd  d0 f7 85 b7 bd d4 f7 85
b9 60 a5 a3 29 87 30 02  a9 00 0a aa bd 5d f7 85
04 bd 5e f7 85 05 a5 a3  29 c0 4a 4a 4a 4a a8 a5
88 8d 82 02 49 ff 25 dd  85 d1 a2 ff ad 82 02 29
08 d0 04 a0 10 a2 0f 86  d2 a2 03 b9 65 f7 45 d1
25 d2 95 06 95 d6 95 d8  c8 ca 10 ef 60 a9 00 e8
95 a2 d0 fb 60 0e 0a 0a  0a 0e 22 22 22 22 22 ee
22 ee 88 ee ee 22 66 22  ee aa aa ee 22 22 ee 88
ee 22 ee ee 88 ee aa ee  ee 22 22 22 22 ee aa ee
aa ee ee aa ee 22 ee f8  f7 f6 06 06 06 16 17 18
19 1a 0a 0a 0a fa f9 f8  f7 f6 f6 06 16 16 17 18
19 1a 1a 0a fa fa f9 e8  e6 e4 f4 04 14 24 26 28
2a 2c 1c 0c fc ec ea c8  c4 c0 e0 00 20 40 44 48
4c 4f 2f 0f ef cf cc 00  00 80 80 84 20 88 88 92
48 a4 a4 a9 52 aa aa d5  aa da da db 6d ee ee 00
fc fc 38 3f 38 fc fc 1c  78 fb 7c 1c 1f 3e 18 19
3a 7c ff df 0e 1c 18 24  64 79 ff ff 4e 0e 04 08
08 6b 7f 7f 7f 63 63 24  26 9e ff ff 72 70 20 98
5c 3e ff fb 70 38 18 38  1e df 3e 38 f8 7c 18 60
70 78 ff 78 70 60 00 00  c1 fe 7c 78 30 30 30 00
03 06 fc fc 3c 0c 0c 02  04 0c 1c fc fc 1e 06 10
10 10 38 7c fe fe 10 40  20 30 38 3f 3f 78 60 40
60 3f 1f 1e 1e 18 18 00  83 7f 3e 1e 0c 0c 0c 00
8e 84 ff ff 04 0e 00 00  0e 04 8f 7f 72 07 00 10
36 2e 0c 1f b2 e0 40 24  2c 5d 1a 1a 30 f0 60 18
5a 7e 5a 18 18 18 78 34  36 5a 78 2c 0c 06 0c 08
6c 70 b8 dc 4e 07 06 38  10 f0 7c 4f e3 02 00 00
0b 16 00 10 00 ff 01 11  01 ff 0f 1f 0f 50 5f 51
ff 30 3f 31 ff 70 7f 71  90 b0 70 ff 91 b1 71 ff
9f bf 7f 08 02 02 02 03  08 1d 05 00 00 00 00 00
00 00 00 00 00 00 00 1d  1d 16 16 0f 0f 00 00 00
00 00 00 00 00 00 12 10  10 0c 0c 07 07 00 00 01
01 00 03 27 03 ea 3c 82  44 32 2c 8a da 80 9c da
3a 64 a8 da 4a 08 04 00  0e f0 10 10 10 10 10 10
10 10 10 10 10 ff 00 00  00 38 00 00 00 60 20 20
23 ff 80 80 00 00 00 1c  04 00 00 00 00 ff 00 00
00 00 00 00 00 00 00 00  00 00 07 1f 3f 7f ff 00
00 00 00 00 00 00 00 60  20 21 ff 00 00 00 80 80
80 80 00 00 00 07 4f cf  8f f6 f6 f6 75 75 75 9a
81 99 aa 9d 8d 99 b6 9d  24 28 08 20 00 48 40 54
58 25 29 49 55 59 a8 88  98 90 a1 83 e8 c8 e0 c0
e9 e2 c1 ff 00 00 00 00  00 00 00 00 00 f0 0f 11
```

Game Audio

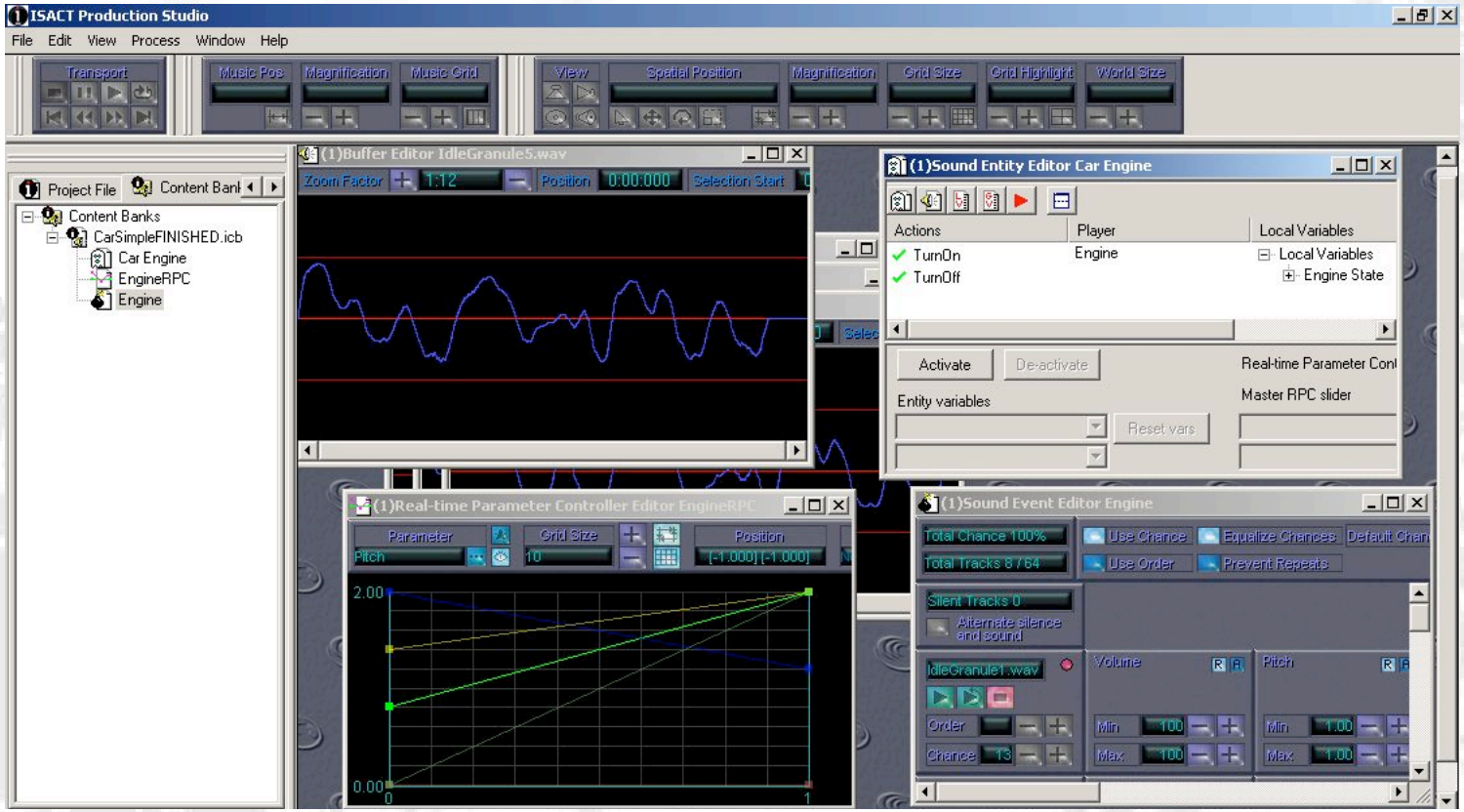
- Playstation 3 Audio (2008)
  - 512+ channels of Atrac3 10:1 decompression
  - 32*MB* of memory on average for audio
  - One 3.2ghz core (of 7) dedicated to audio
  - Convolution reverbs, realtime multiband compression, physical modeling, granulation, 3d waveguide reverb mesh simulation, digital 7.1 ..

Game Audio

Are we “done” ?

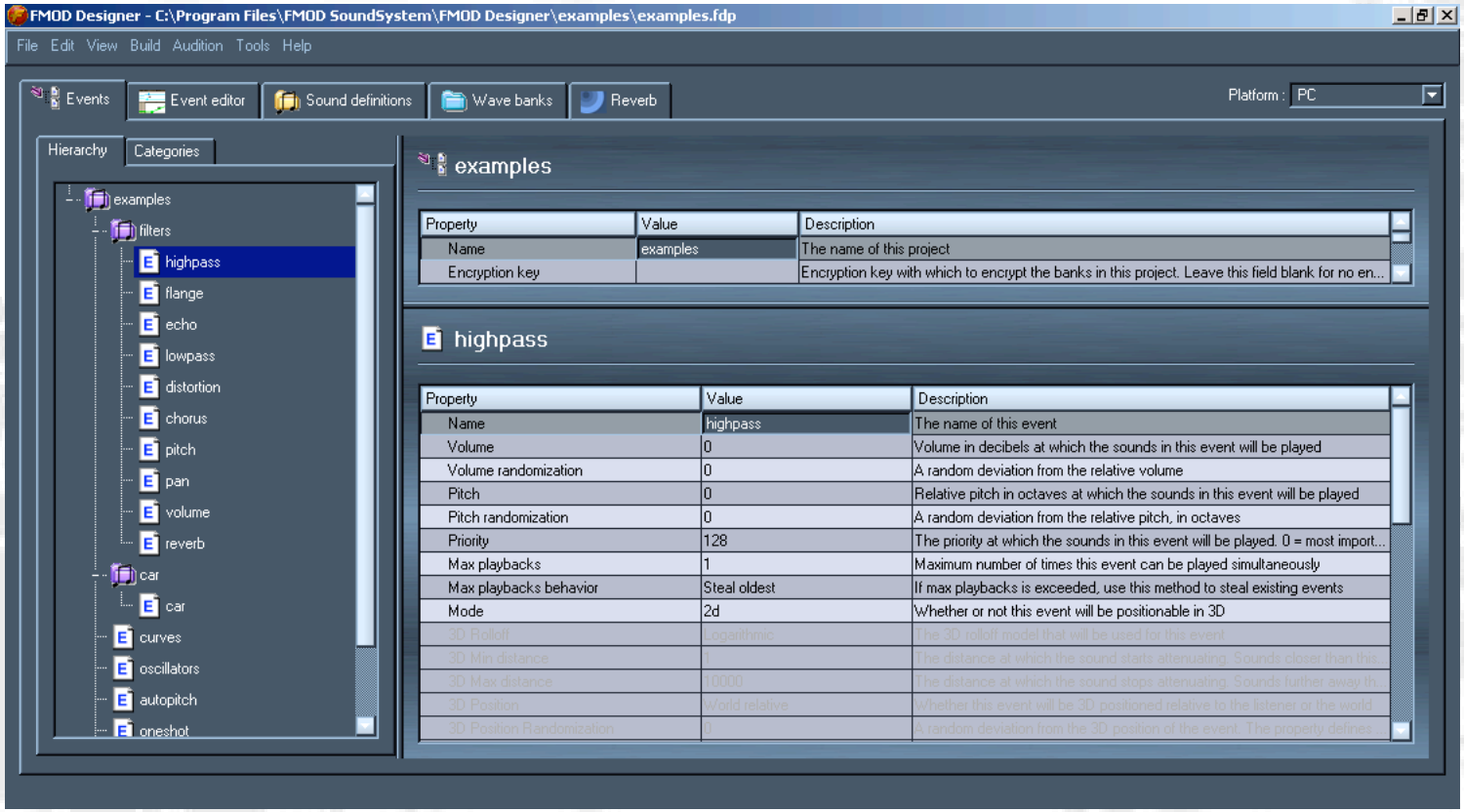
Tools

- Tools: Isact



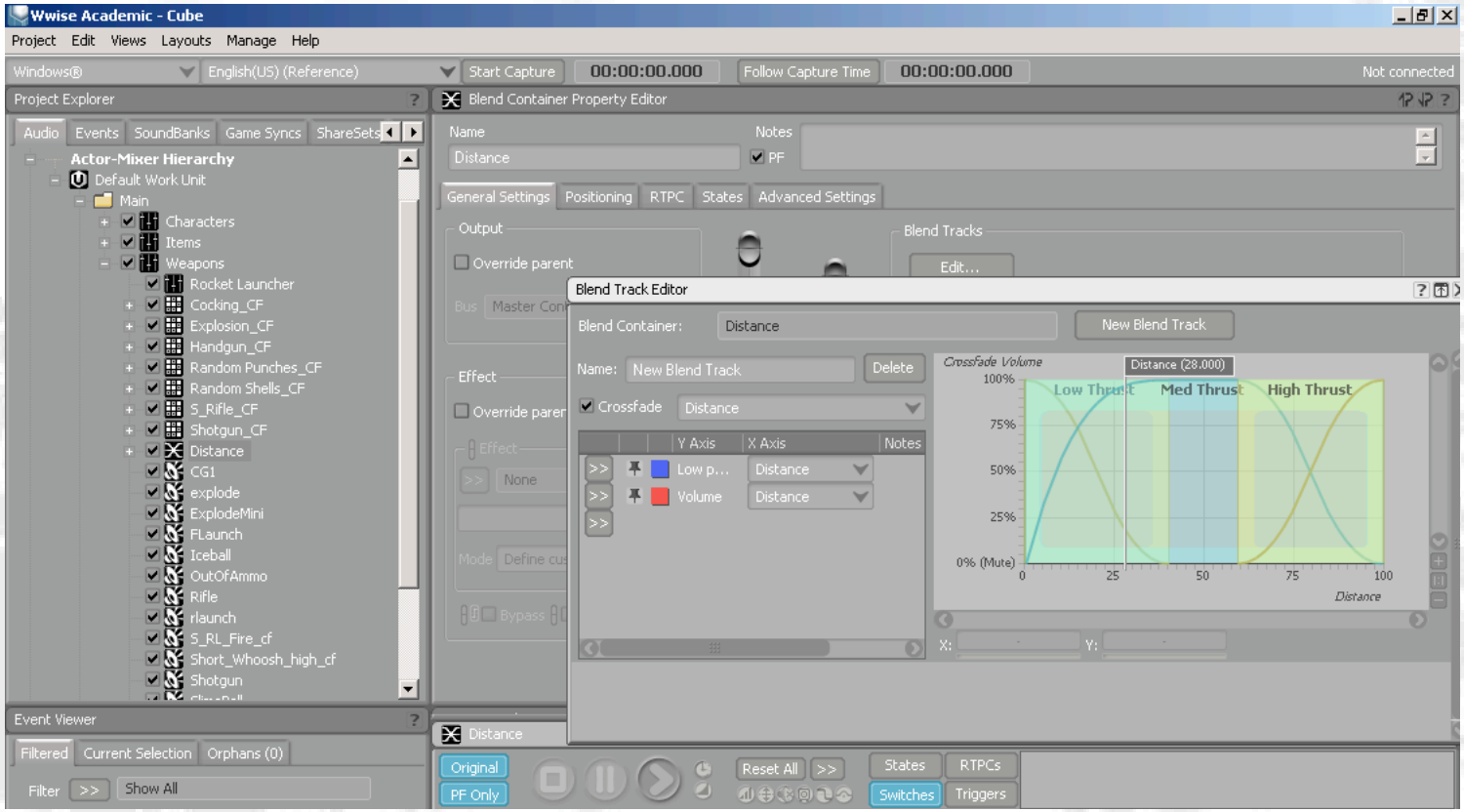
Tools

- Tools: FMod



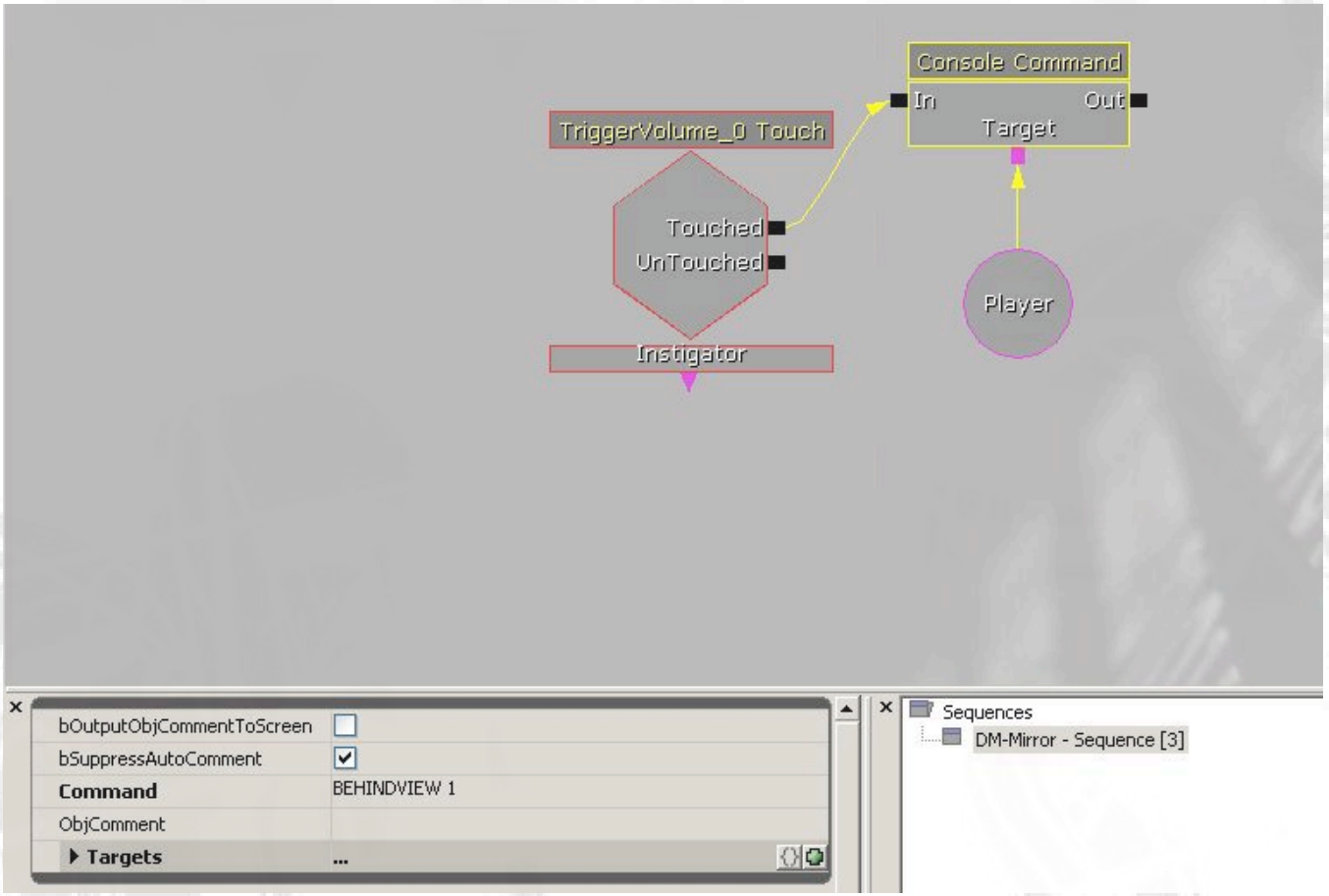
Tools

- Tools: Wwise



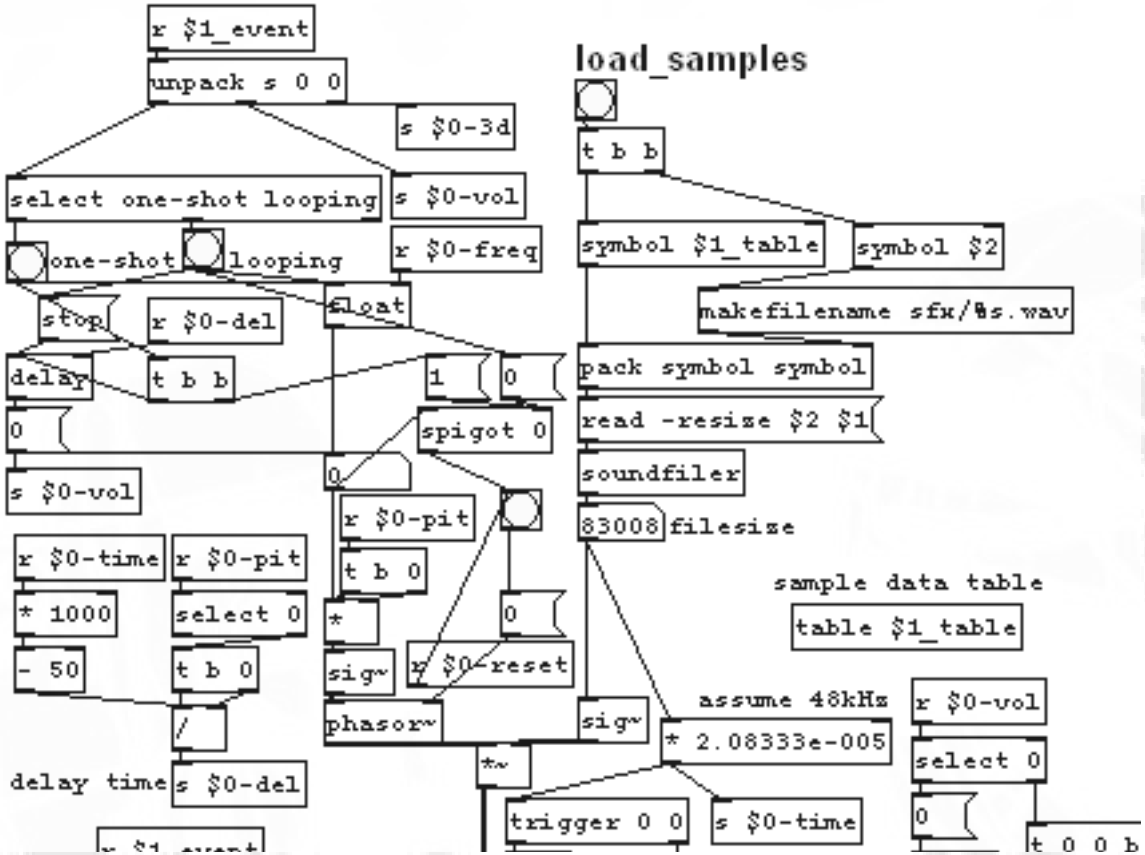
Tools

- Tools: Unreal Kismet Editor



Tools

- Tools: Pure Data



“2-D”Game Audio Dillema

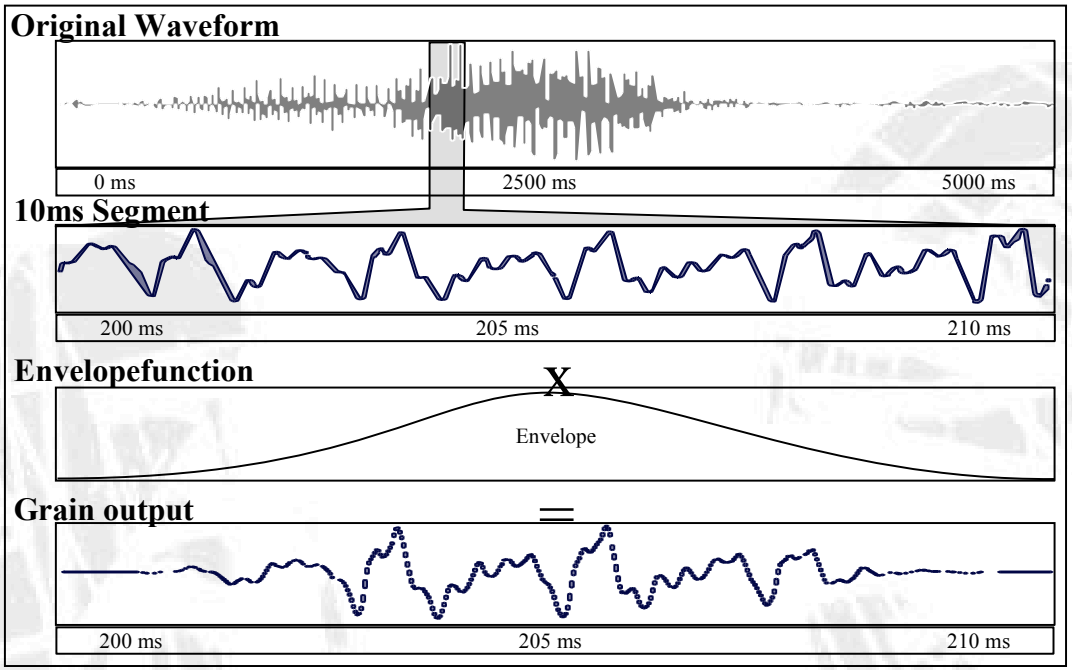
- Brandenburg Concertos (Bach) – c.1721
- Samples are pre-generated, like 2-d graphics
- Examples:

  1. Computer synthesized
  2. MIDI score
  3. Synth Performance
  4. Live Instruments

- How to improve game audio?

Granulation

- Split a sampled sound into small “grains”
- Playback of grains allows us independent control of frequency and tempo



Concatenative Synthesis

- Uses grains of one sound to approximate the original sound, like an “audio mosaic”
- Good for making new textures that are similar

Figure 1: Photo-Mosaic

Figure 2: Detail of Figure 1

Conclusion

How do we make audio for games more expressive ?

Questions ?

Info { at } VideoGameAudio.com

VideoGameAudio.com