

The background is a screenshot from the game Vessel, showing a dark, industrial environment with yellow pipes, gears, and a large yellow wheel. A small blue creature is visible in the upper center.

The Dynamic Audio of Vessel

Leonard J. Paul
Chairman, Lotus Audio Corp.

<http://VideoGameAudio.com>

GAME DEVELOPERS CONFERENCE

SAN FRANCISCO, CA
MARCH 5-9, 2012
EXPO DATES: MARCH 7-9

2012

Resources:

Email:

Info{at}VideoGameAudio.com

Web:

VideoGameAudio.com

Twitter:

Twitter.com/VideoGameAudio



The screenshot shows the homepage of the Video Game Audio website. At the top is a large, stylized green logo for 'VIDEO GAME AUDIO' with a 3D effect. Below the logo, the text 'Video Game Audio Articles by Leonard J. Paul' is displayed. A paragraph follows, detailing Leonard Paul's background in computer science and game audio. Below this is a 'NEWS' section with a red stamp icon and the title 'School of Video Game Audio'. It includes a sub-headline 'NEWS: School opens to the public in early 2012' and a 'Click to apply' link. Further down, there's a Twitter feed section titled 'News: via VideoGameAudio on Twitter.com/VideoGameAudio' with a 'Follow @VideoGameAudio' button showing 763 followers. The feed contains several tweets about vinyl releases, Vessel game updates, and GDC 2012. At the bottom, there's a section for 'Presentations and Writings'.

VIDEO GAME AUDIO

Video Game Audio Articles by Leonard J. Paul

Leonard Paul attained his Honours degree in Computer Science at Simon Fraser University in BC, Canada with an Extended Minor in Music concentrating in Electroacoustics. He began his work in video games on the Sega Genesis and Super Nintendo Entertainment System and has a fifteen year history in composing, sound design and coding for games working for companies such as Electronic Arts, Backbone Entertainment, Radical Entertainment, moderngroove entertainment, Rockstar Vancouver and Black Box Games. He has worked on over twenty major game titles totalling over 6.4 million units sold since 1994, including award-winning AAA titles such as EA's *NBA Jam*, *NHL11*, *Need for Speed: Hot Pursuit 2*, *NBA Live '96* as well as the indie award-winning title *Retro City Rampage*. [✚]

NEWS

School of Video Game Audio



NEWS: School opens to the public in early 2012
Click to apply

News: via VideoGameAudio on Twitter.com/VideoGameAudio

Follow @VideoGameAudio 763 followers

- "Wow! Sold out green vinyl on ebay for \$150: <http://t.co/z1bitMvv>. Over \$100 less for black or blue :) <http://t.co/qV00oRk#in>"
1 day ago
- "Wow. Vessel is currently at a 86% Metacritic: <http://t.co/9TJHnaky>"
2 days ago
- "I'm right at the end this nice photo set - thanks @Jerlaskal RT @nobuooo: #GDC 2012 - our complete photo set: <http://t.co/06uocvVv>"
2 days ago
- "Nice! RT @brettshipes: Ready to dedicate the rest of this lovely Saturday to playing Vessel @VideoGameAudio"
2 days ago
- "I'm doing last talk #GameAudioGDC -Fri 4pm #3004-"Dynamic Audio of Vessel"-Indie audio tricks&more:<http://t.co/EYDJzaAt>"
3 days ago

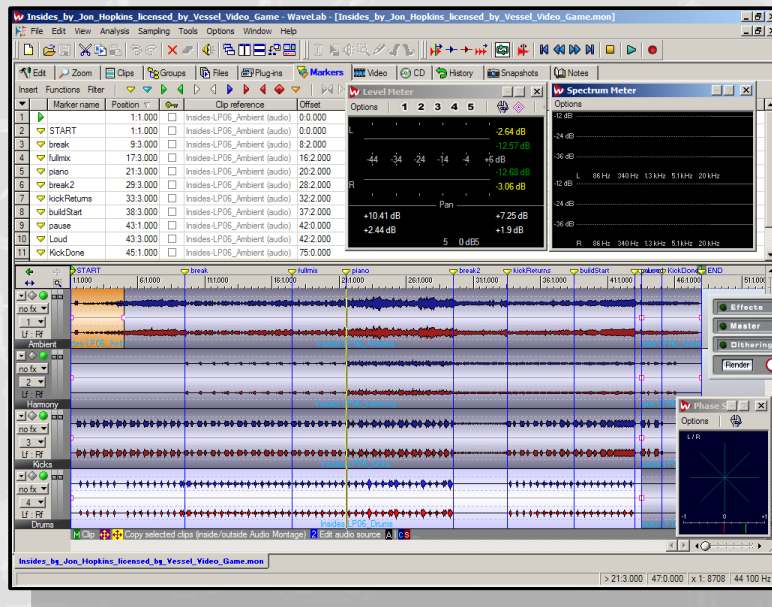
Presentations and Writings:

Vessel by Strange Loop Games



- Trailer video - <http://www.strangeloopgames.com/>

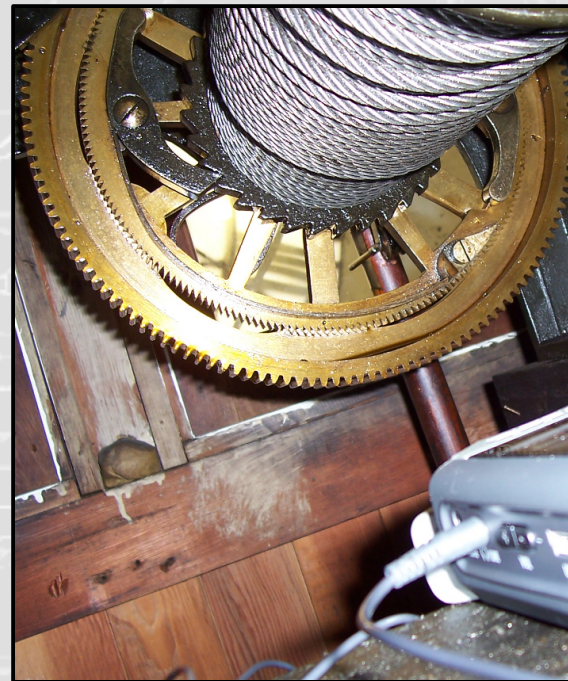
Music of *Vessel*



- Video on music – Jon Hopkins soundtrack in Vessel - YouTube

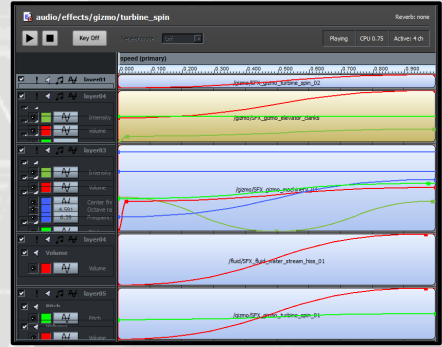
Vessel Sound Design

- Every sound was recorded on a Zoom H4N recorder
- No digital effects used except real-time FMOD fx
- Sounds from Columbian rainforests, 100 year-old clock towers & more
- Emphasis on real sounds



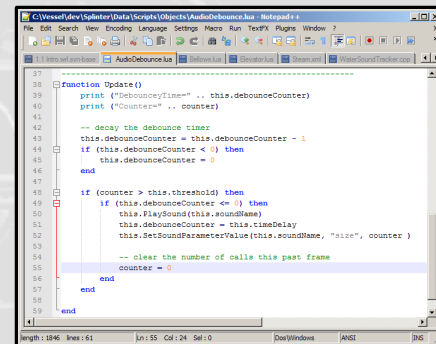
FMOD

- Robust audio library and designer tool
- Shipped in many games since 2002
- Cross-platform: PC, 360, PS3, Vita, Mac, iOS, Wii, 3DS + more
- Good: Parameter modulation, FX, cost & speed
- Cons: Mixing, interactive music & presentation
- Overall, it's a very strong toolset and library
- New FMOD Studio is coming very soon in 2012

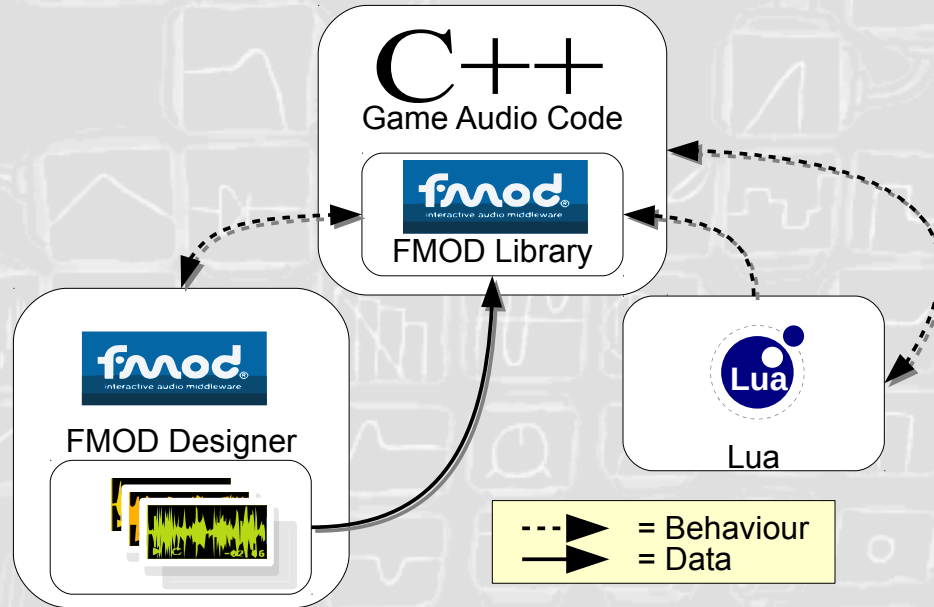


Lua

- Free open source scripting
- Fast, easy and efficient
- Implementation layer between FMOD library and C++ code
- Allows sound artist to make complex state aware behaviours not possible in FMOD
- Used extensively throughout Vessel
- Doesn't require recompilation
- Great scripting language for video games

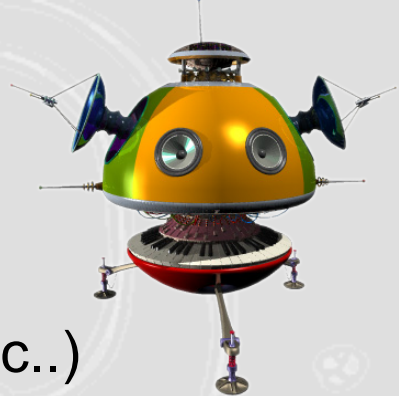


Data and Control Flow



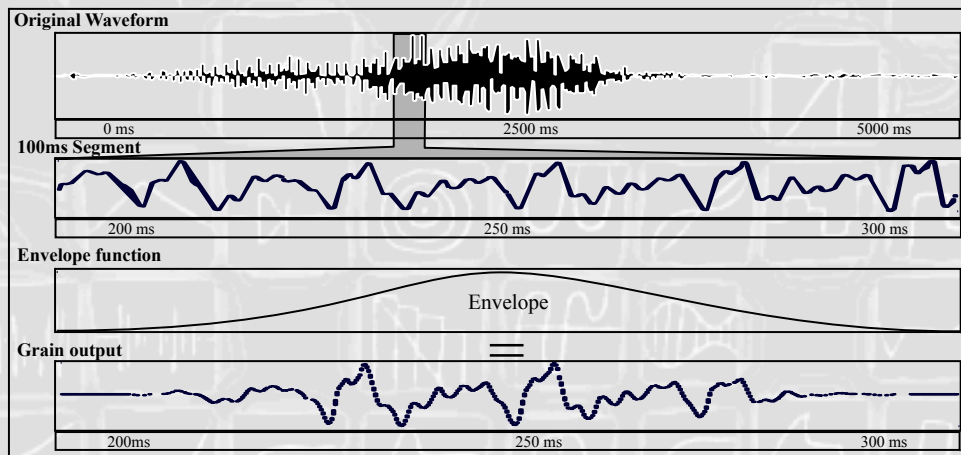
- Audio and data flow to the game code from FMOD with the possibility of control data from Lua

Procedural Audio



- Generate audio in real-time based on rules and behaviours (physical modeling, modal synthesis etc..)
- Main advantage is the possibility of realism
- Drawbacks include realism, scalability, dev time & CPU time
- Can combine samples, effects & procedural audio
- Granulation is a common technique used in *Vessel*

Granulation



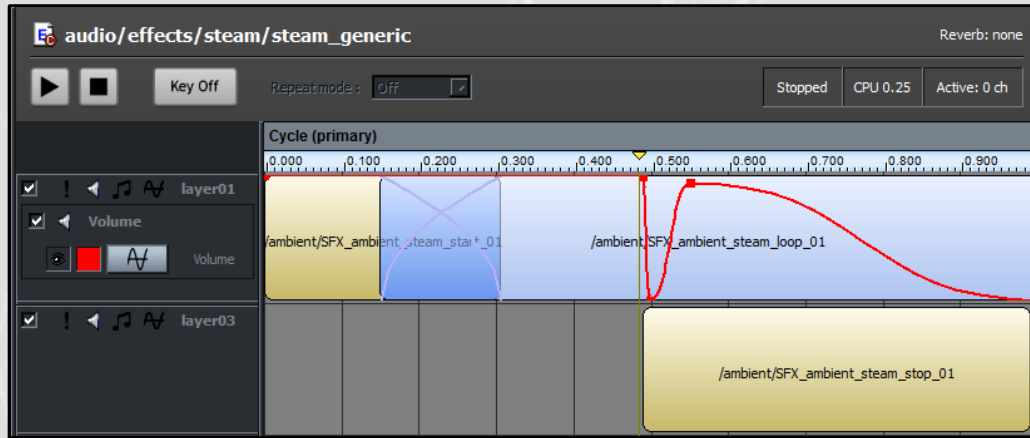
- Splits sample into small granules & decreases repetition
- Independent control of frequency and tempo
- Manual segmentation done in *Vessel* to preserve transients

Basic Examples

- Sequencing
- Layering
- Layered sequencing
- Spectral layering
- LFO Effects Modulation
- Asymmetric Loops
- Effect Curves

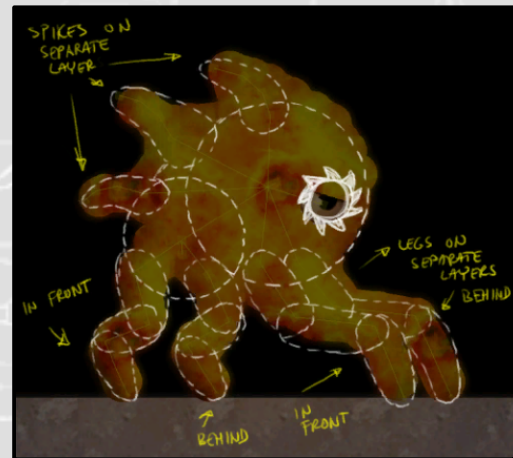
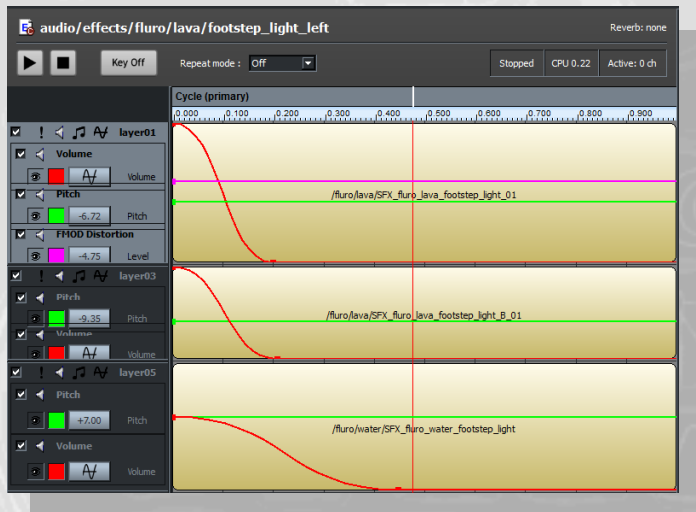


Sequencing



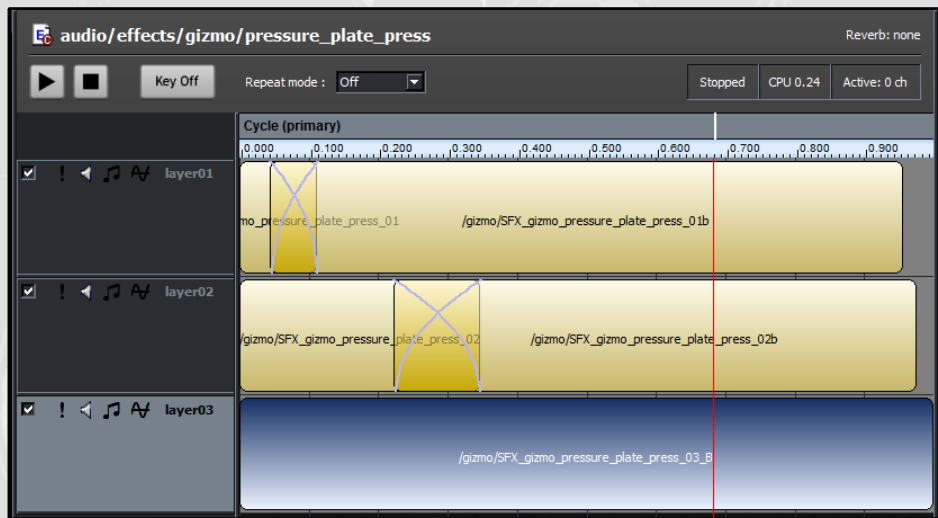
- A basic start, loop and stop layout for steam
- Yellow cue point marks the sustain section

Layered



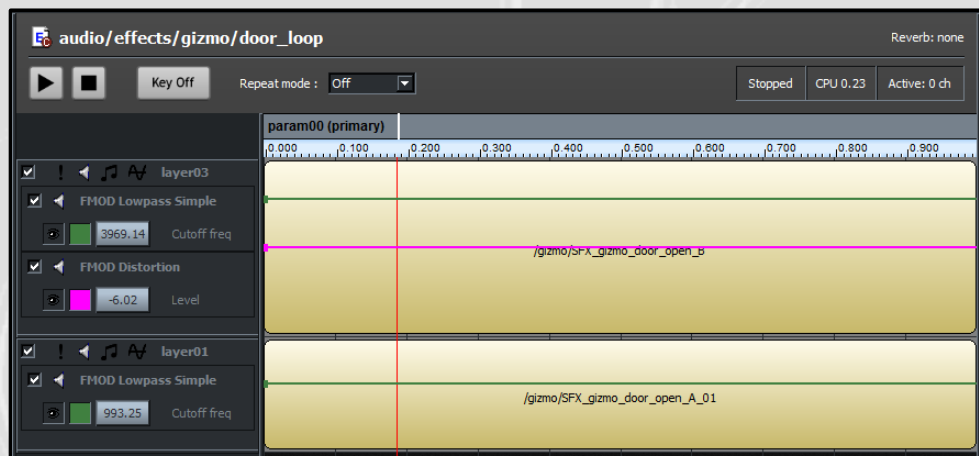
- Lava fluro footsteps: Lava hiss is in layer one, gloopy squish sound in layer two and wet sloppy sound on bottom

Layered Sequencing



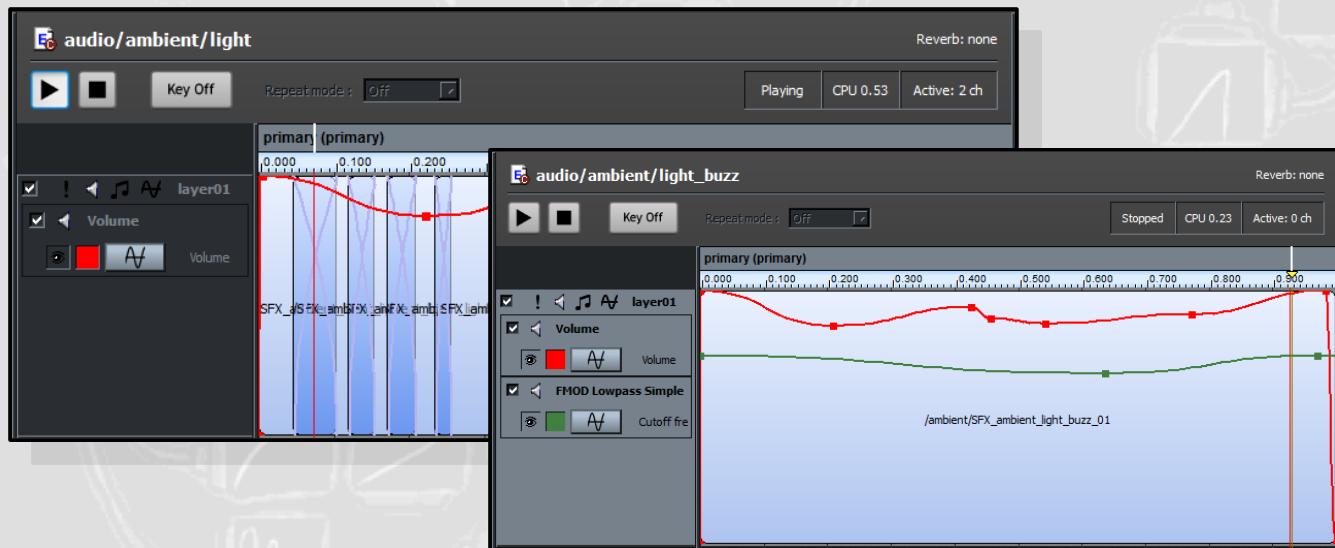
- Split attack and remainder of sample into chunks
- Randomize start times of samples for variation

Spectral Layering



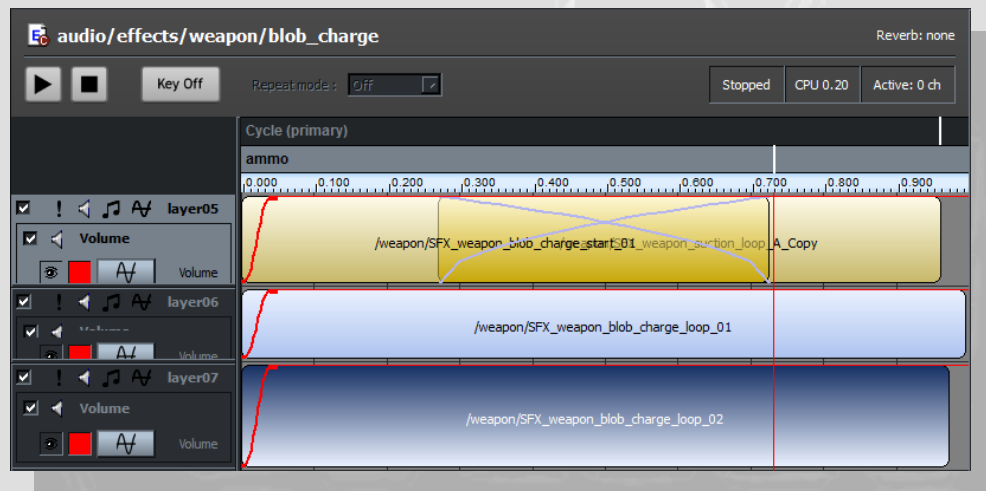
- High frequencies on top layer and low frequencies on the bottom layer
- LP filter to separate layers and add distance

LFO Effects Modulation



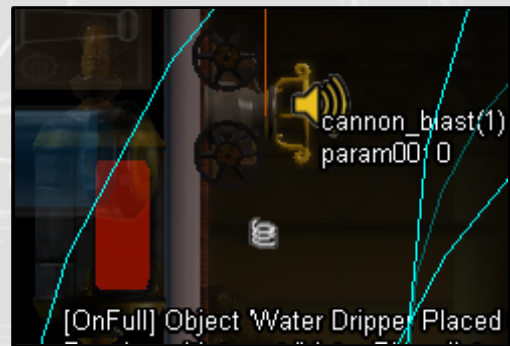
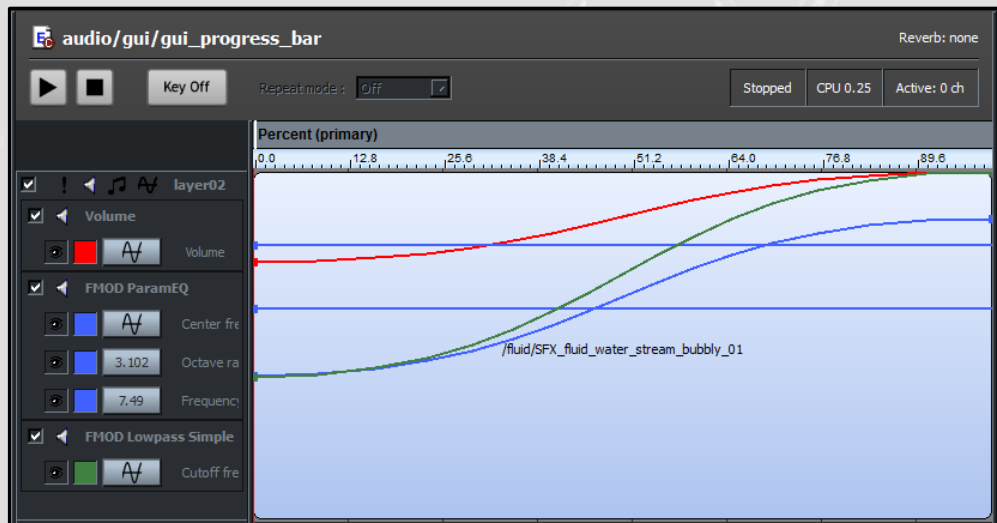
- Slowly modulate volume, low-pass filter and crossfade between samples for variation

Asymmetric Loops



- Three loops of slightly different lengths are looped to simulate the blob charge weapon sound

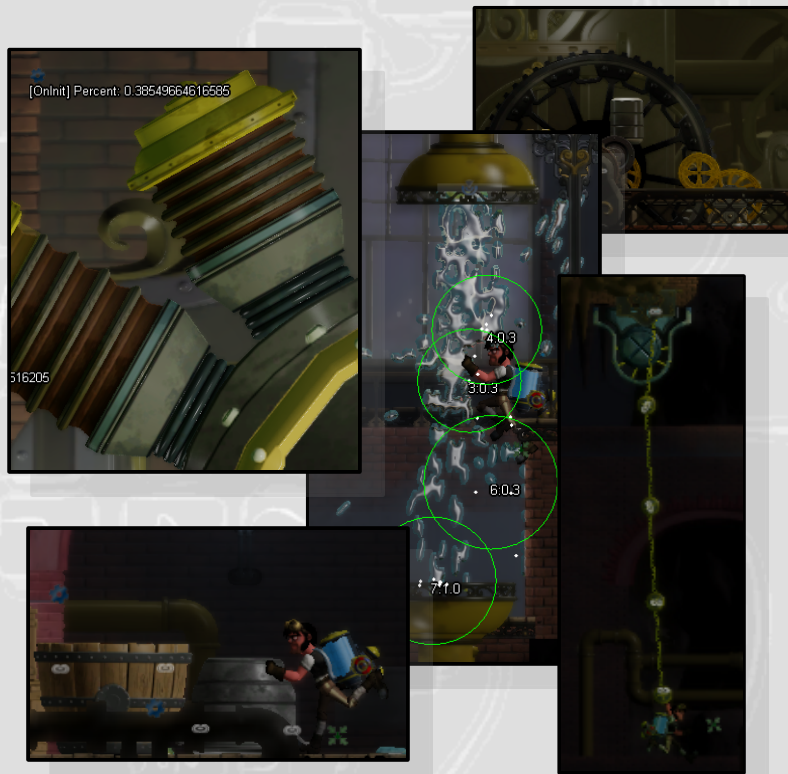
Effect Curves



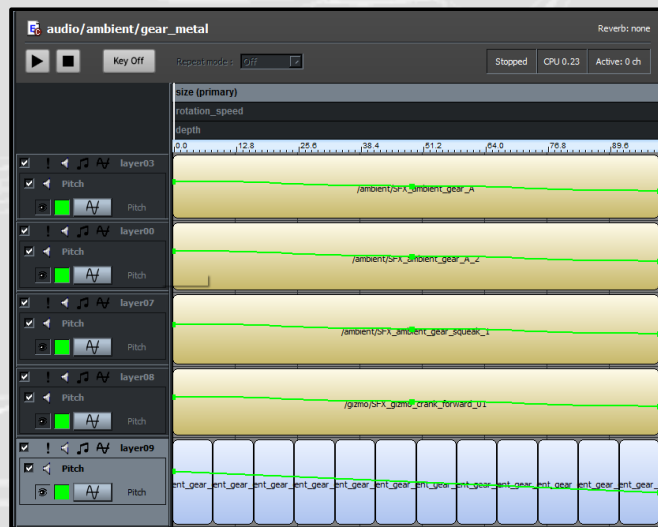
- Progress bar uses EQ with a changing centre frequency to simulate liquid filling a container

Advanced Examples

- Multiple effects modulation
- Granulation
- Water
- Constraints
- Synthesis
- Lua scripting

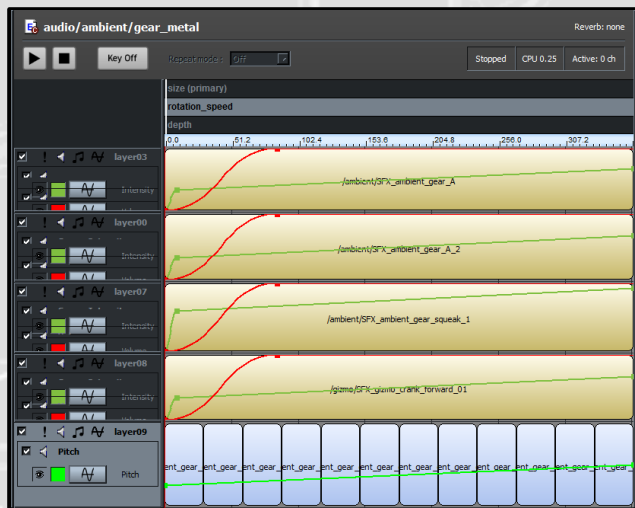


Multiple Effect Modulation: Size



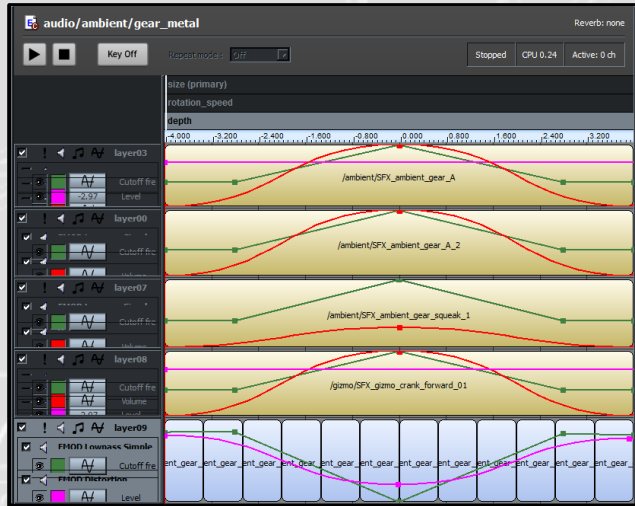
- The size corresponds to the pitch curve which drops with an increase in size

Multiple Effect Modulation: Speed



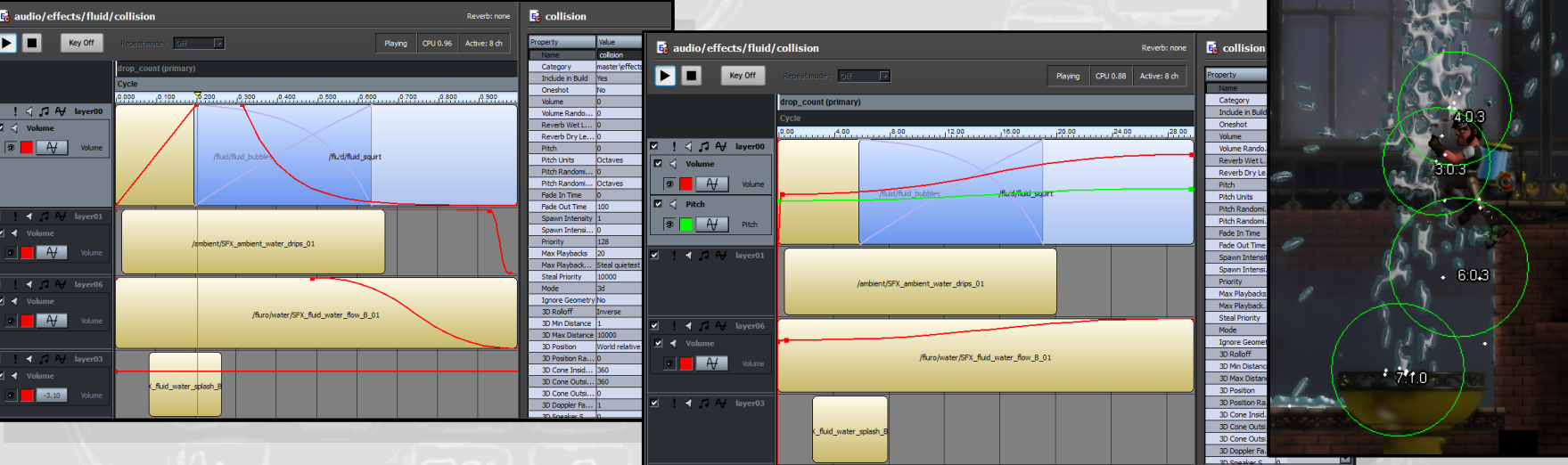
- Speed increases spawn rate on cog granules for top three layers, increases playback rate and volume

Multiple Effect Modulation: Distance



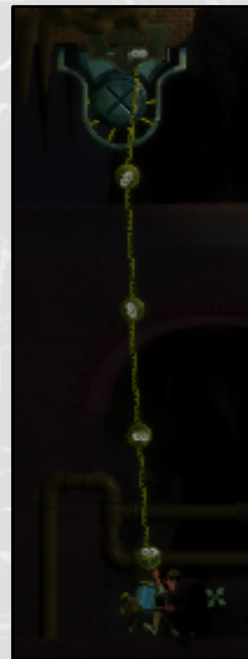
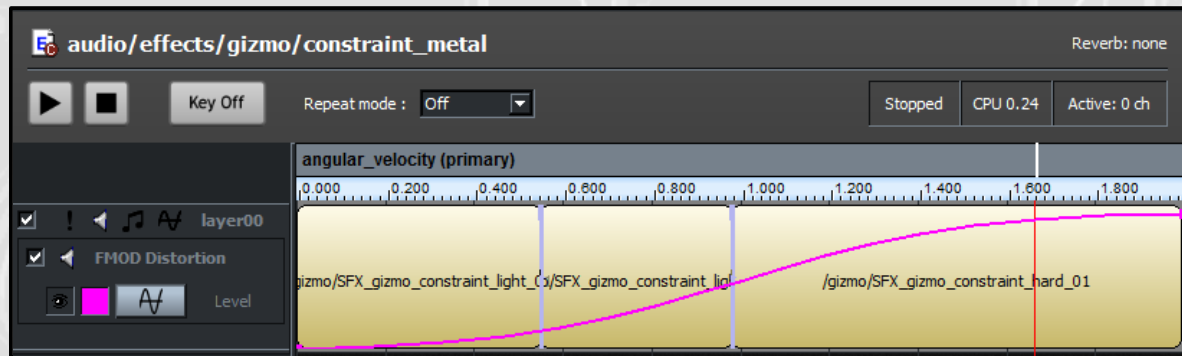
- Ambient gear sounds at bottom play when camera is distant and more of the granulated closeup gears played otherwise

Water



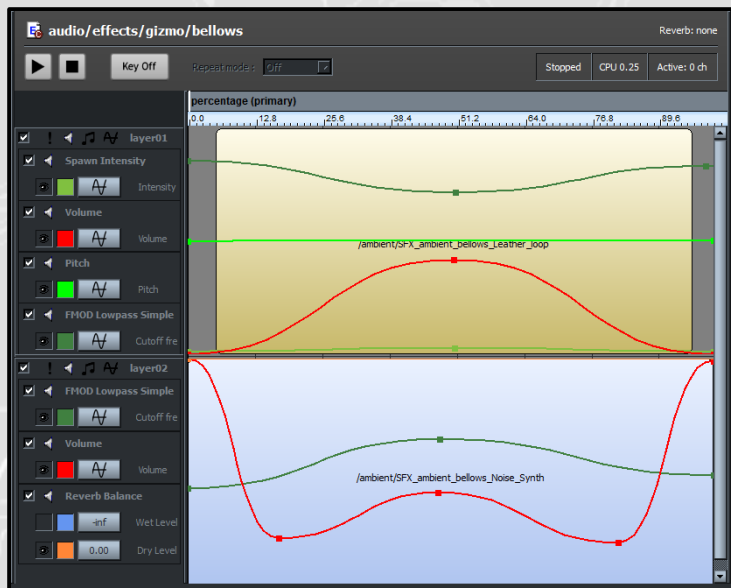
- Dynamic water audio done in C++ by grouping collisions – drop_count on left in green circle, hardness is on right
- Slosh at bottom triggered by water movements

Constraints



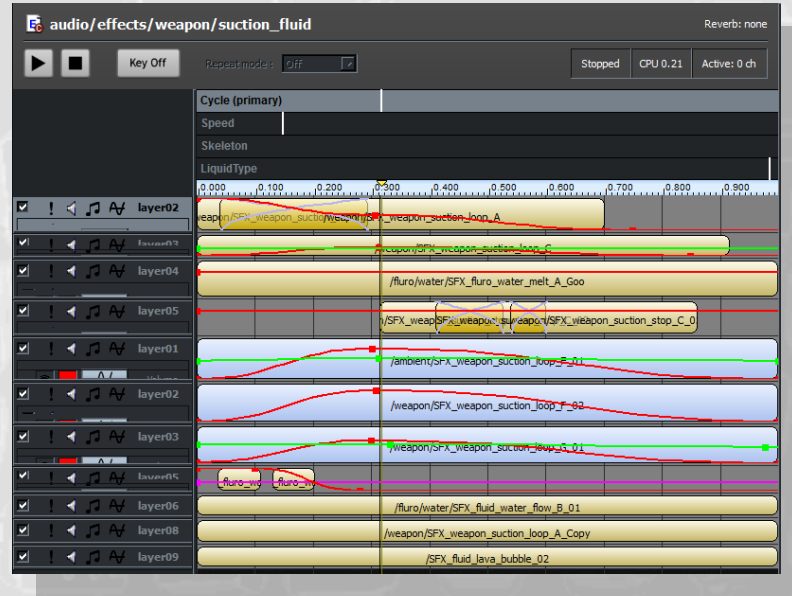
- Used for squeaks and metal chain shakes
- Driven by angular velocity on joints

Granulation and Subtractive Synthesis



- Air is synthesized by subtractive synthesis
- Leather squeaks are granulated

Multiple Methods



- Combine granulation, layering, sequencing, fx modulation and more into the water suction weapon sound

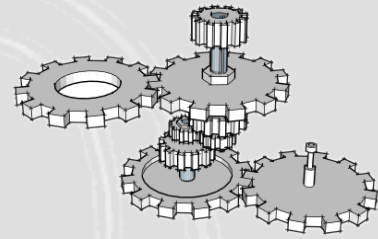
Lua

```
-- LJP: start/stop looping s
if (this.CurrentSpeed > 0.1)
    if (not isSoundPlayi
        this.PlaySoun
        isSoundPlaying = tru
    end
    this.SetSoundParamet
else
    if (isSoundPlaying)
        this.StopSoun
    end
end
-- LJP: }
```

```
function Update()
    print ("Counter=" .. counter)
    -- decay the debounce timer
    this.debounceCounter = this.debounceCounter - 1
    if (this.debounceCounter < 0) then
        this.debounceCounter = 0
    end
    if (counter > this.threshold) then
        if (this.debounceCounter <= 0) then
            this.PlaySound(this.soundName)
            this.debounceCounter = this.timeDelay
            this.SetSoundParameterValue(this.soundName, "size", counter )
            -- clear the number of calls this past frame
            counter = 0
        end
    end
end
end
```

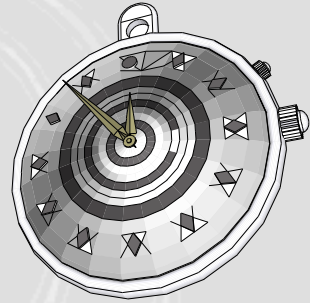
- Great for tuning behaviours not covered by FMOD such as sound event call debouncing
- Used a lot for interactive objects (“gizmos”)

Workflow



- Vessel is a physics based game so rapid iteration to explore potential outcomes is key
- The sound artist can quickly update all data and behaviours without recompilation
- Address all bottlenecks as they appear
- Reload sound banks when pausing game
- Make content development as interactive as possible

Speed



1. Add new sound events – 5 seconds
2. Game connect via FMOD – 5 seconds
3. Reload individual Lua script – 10 seconds
4. Reload all soundbanks/scripts – 10 seconds
5. Rebuild FMOD 250MB soundbank – 15 seconds
6. Clean rebuild of all soundbanks – 300 seconds

Questions ?

Email:

Info{at}VideoGameAudio.com

Web:

VideoGameAudio.com

Twitter:

Twitter.com/VideoGameAudio

VIDEO GAME AUDIO

Video Game Audio Articles by Leonard J. Paul

Leonard Paul attained his Honours degree in Computer Science at Simon Fraser University in BC, Canada with an Extended Minor in Music concentrating in Electroacoustics. He began his work in video games on the Sega Genesis and Super Nintendo Entertainment System and has a fifteen year history in composing, sound design and coding for games working for companies such as Electronic Arts, Backbone Entertainment, Radical Entertainment,摩登groove entertainment, Rockstar Vancouver and Black Box Games. He has worked on over twenty major game titles totalling over 6.4 million units sold since 1994, including award-winning AAA titles such as EA's *NBA Jam*, *NHL 11*, *Need for Speed: Hot Pursuit 2*, *NBA Live '95* as well as the indie award-winning title *Retro City Rampage*. [4]

NEWS

School of
Video Game Audio



NEWS: School opens to the public in early 2012
Click to apply

News: via [VideoGameAudio](#) on [Twitter.com/VideoGameAudio](#)

Follow @VideoGameAudio 763 followers

- "Wow! Sold out green vinyl on ebay for \$150: [#in](http://t.co/qfV0oRk)"
1 day ago
- "Wow. Vessel is currently at a 86% Metacritic: <http://t.co/9TJHnaky>"
2 days ago
- "I'm right at the end this nice photo set - thanks @Jeriaska! RT @nobuooo: #GDC2012 - our complete photo set: <http://t.co/06uoqvVv>"
2 days ago
- "Nice! RT @brettshipes: Ready to dedicate the rest of this lovely Saturday to playing Vessel @VideoGameAudio"
2 days ago
- "I'm doing last talk #GameAudioGDC - Fri 4pm #3004-"Dynamic Audio of Vessel"-Indie audio tricks&more:<http://t.co/EYDjzaAt>"
3 days ago

Presentations and Writings: