

Sounding Out! Podcast #29: Game Audio Notes I: Growing Sounds for Sim Cell

gameaudioschool

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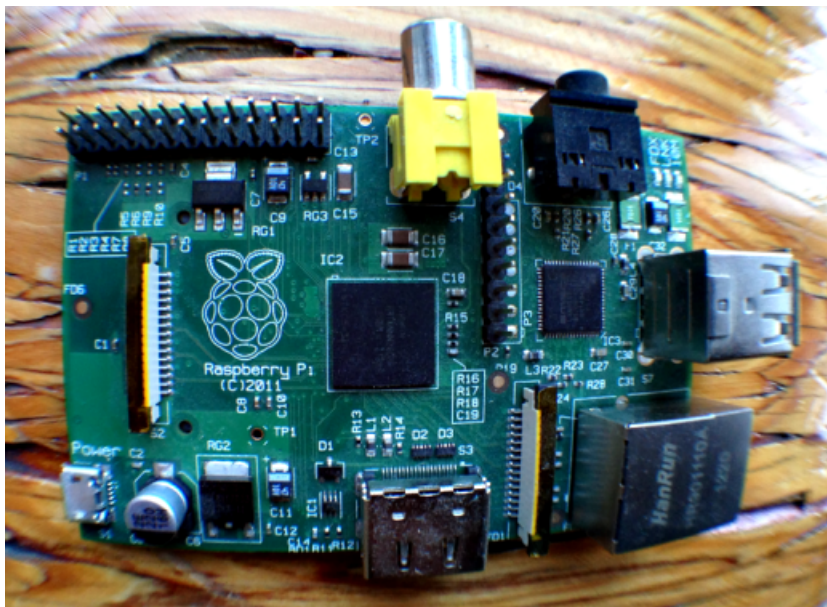
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Abstract

A pair of firsts! This is both the lead post in our summer Sound and Pleasure series, and the first podcast in a three part series by Leonard J. Paul. What is the connection between sound and enjoyment, and how are pleasing sounds designed?

Keywords

Music (Subfield), Digital Media, Methodology, Podcast, Recording, Sampling And Remix Culture



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A pair of firsts! This is both the lead post in our summer **Sound and Pleasure** series, and the first podcast in a three part series by Leonard J. Paul. What is the connection between sound and enjoyment, and how are pleasing sounds designed? Pleasure is, after all, what brings y'all back to *Sounding Out!* weekly, is it not?

In today's installment Leonard peels back the curtain of game audio design and reveals his creative process. For anyone curious as to what creative decisions lead to the bleeps, bleeps, and ambient soundscapes of video games, this is essential listening. Stay tuned for next Monday's installment on the process of designing sound for Retro City Rampage, and next month's episode which focuses on the game Vessel. Today, Leonard begins by picking apart his design process at a cellular level. Literally! **-AT, Multimedia Editor**

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https://soundstudiesblog.com/wp-content/uploads/2014/05/growing-sounds-for-sim-cell_leonardjpaul_sovga_soundingoutpodcas.mp3

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Game Audio Notes I: Growing Sounds for Sim Cell

Sim Cell is an educational game released in Spring 2014 by [Strange Loop Games](#). Published by [Amplify](#), a branch of News Corp, it teaches students how the human cell works. Players take control of a small vessel that is shrunk down to the size of a cell and solve the tasks set by the game while also learning about the human cell. This essay unpacks the design decisions behind the simulation of a variety of natural phenomena (motion, impact, and voice) in *Sim Cell*.

For the design of this game I decided to focus on the elements of life itself and attempted to “grow” the music and sound design from synthetic sounds. I used the visual scripting language [Pure Data](#) (PD) to program both the sounds and the music. The music is generated from a set of rules and patterns that cause each playback of a song to be slightly different each time. Each of the sound effects are crafted from small programs that are based on the design of analogue modular synthesizers. Basic synthetic audio elements such as filtered noise, sawtooth waves and sine waves were all used in the game's sound design.



A screenshot of Sim Cell's microscopic space-like world. Used with permission (c) 2014 Amplify.

The visuals of the game give a feeling of being in an “inner space” that mirrors outer space. I took my inspiration for *Sim Cell*'s sound effects from Louis and Bebe Baron's score to [Forbidden Planet](#). I used simple patches in PD to assemble all of the sounds for the game from synthesis. There aren't any recorded samples in the sound design – all of the sound effects are generated from mathematics.

The digital effects used in the sound design were built to emulate the effects available in vintage studios such as plate reverb and analog delay. I found a simulation of a plate reverb that from a modified open source patch from the [RjDj project](#), and constructed an analogue delay by using a low-pass filter on a delayed signal.

<https://www.youtube.com/watch?v=3m86ftny1uY&feature=youtu.be>

In keeping with the vintage theme, I used elements of sound design from the early days of video games as well. Early arcade games such as *Space Invaders* used [custom audio synthesis microchips](#) for each of their sounds. In order to emulate this, I gave every sound its own patch when doing the synthesis for *Sim Cell*. I learned to appreciate this ethic of design when playing *Combat* on the Atari 2600 while growing up. The Atari 2600 could only output two sounds at once thus had a very limited palette of tones. All of the source code for the sounds and music for *Sim Cell* are less than 1 megabyte, which shows how powerful the efficient coding of mathematics can be.



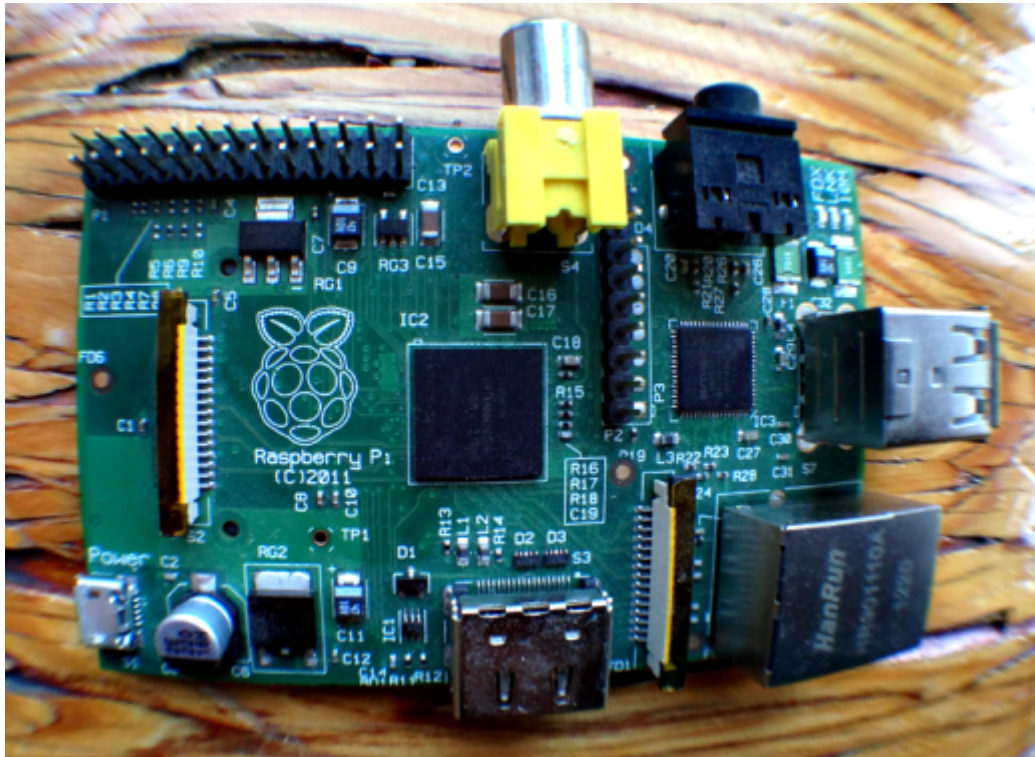
Vector image on the left, raster graphics on the right. Photo used with permission by the author.

Another cool thing about generating the sounds from mathematics is that users can “zoom in” on sounds in the same way that one can zoom in to a [vector drawing](#). In vector drawings the lines are smooth when you zoom in, as opposed to rasterized pictures (such as a JPEG) which reveal a blurry set of pixels upon zooming. When code can change sounds in real-time, it makes them come alive and lends a sense of flexibility to the composition.

For a human feeling I often filter the sounds using [formant frequencies](#) which simulate the resonant qualities of vowel sounds, thus offering a vocal quality to the sample. For alarm sounds in *Sim Cell* I used minor second intervals. This lent a sense of dissonance which informed players that they needed to adjust their gameplay in order to navigate treacherous areas. Motion was captured through a whoosh sound that used filtered and modulated noise. Some sounds were pitched up to make things seem like they were travelling towards the player and likewise they exploited a sense of [doppler shift](#) when pitched down, giving the feel that a sound was traveling away from the player. Together, these techniques produced a sense of immersion for the player while simultaneously building a realistic soundscape.

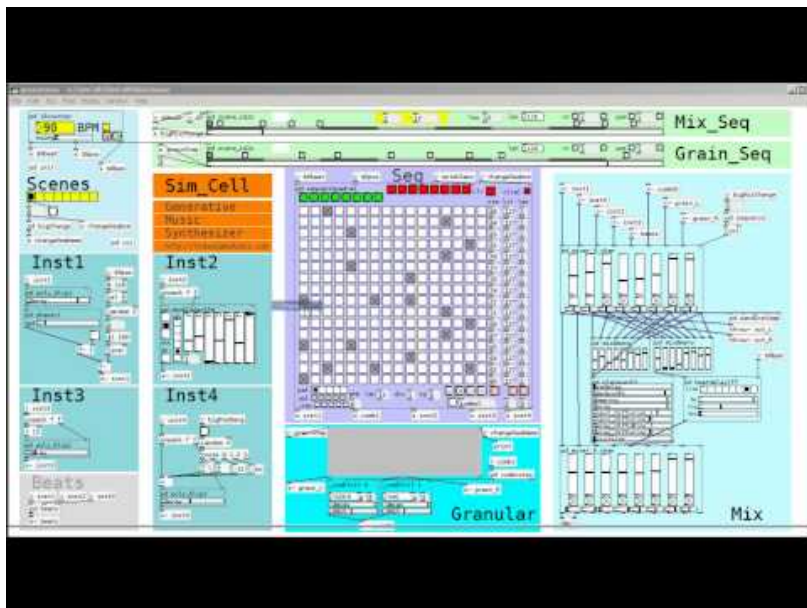
Our decision to use [libPD](#) for this synthesis turned problematic and its processing requirements were too high. In order to remedy this, we decided to convert our audio into samples. Consider a photograph of a sculpture. Our sounds, like sculpture in the photograph, could now only be viewed from one direction. This meant that the music now only had a single version and that sound effects would repeat as well. A small fix was exporting the file with a set of five different intensities from 0 to 1.0. Like taking a photograph from several angles, this meant that the game could play a sample at intensity levels of 20%, 40%, 60%, 80% and 100%. Although a

truly random sense of variation was lost, this method still conveyed the intensity of impacts (and other similar events) generated by the physics engine of the game.



An image of the inexpensive open-source computer: The Raspberry Pi. Photo used with permission by the author.

PD is a great way to learn and play with digital audio since you can change the patch while it is running, just like you might do with a real analogue synthesizer. There's plenty of other neat stuff that PD can do, like being able to be run on the [Raspberry Pi](#), so you could code your own effects pedals and make your own synths using PD for around \$50 or so. For video games, you can use libPD to integrate PD patches into your Android or iOS apps as well. I hope this essay has offered some insight as to my process when using PD. I've included some links below for those interested in learning more.



<https://youtu.be/0xr4aL1C24E>

Additional resources:

- “The Generative Music and Procedural Sound Design of Sim Cell” – [School of Video Game Audio](#)
- Pure Data – download extended from [Puredata.info](#) for all platforms
- Download 10 free patches demonstrating the sound effects in Sim Cell from my site at [VideoGameAudio.com](#) – search for “Patches” section for “10 Procedural Sound Design Patches” – Power down, fat synth, spaceship, whoosh, robot blabber, missile, alising scream, alien blast, computery, explosion and bonus synth cat meow sound
- Miller Puckette’s book “[The Theory and Technique of Electronic Music](#)” – free 300+ page book using Pure Data
- “[Designing Sound](#)” by Andy Farnell has great patches in it from fires to guns to birds – great for game audio
- Download [student patches](#) from previous times I’ve taught at Emily Carr University

Leonard J. 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 twenty year history in composing, sound design and coding for 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 2010*, *NHL11*, *Need for Speed: Hot Pursuit 2*, *NBA Live ’95* as well as the indie award-winning title *Retro City Rampage*.

He is the co-founder of the [School of Video Game Audio](#) and has taught game audio students from over thirty different countries online since 2012. His new media works has been exhibited in cities including Surrey, Banff, Victoria, São Paulo, Zürich and San Jose. As a documentary film composer, he had the good fortune of scoring the original music for multi-awarding winning

documentary *The Corporation* which remains the highest-grossing Canadian documentary in history to date. He has performed live electronic music in cities such as Osaka, Berlin, San Francisco, Brooklyn and Amsterdam under the name Freaky DNA.

He is an internationally renowned speaker on the topic of video game audio and has been invited to speak in Vancouver, Lyon, Berlin, Bogotá, London, Banff, San Francisco, San Jose, Porto, Angoulême and other locations around the world.

His writings and presentations are available at <http://VideoGameAudio.com>

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Featured image: Concept art for Sim Cell. Used with permission (c) 2014 Amplify.

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