

# Game Boy Sound

A case study in video  
game music preservation



# Overview

- Meet the Game Boy
- Comparison of preservation methods for Game Boy music
- It gets more complicated

# About the Game Boy Family

- Family of handheld game consoles originally released in 1989
- One of the top-selling console families of all time, with 118.69 units sold
- Has had many iterations:
  - Game Boy (1989)
  - Game Boy Pocket (1996)
  - Game Boy Color (1998)
  - Game Boy Advance (2001)
  - Game Boy Advance SP (2003)
  - Game Boy Micro (2005)



# Game Boy (1989) Specifications

- CPU: 4.19 MHz similar to Zilog Z80
- RAM: 8kB
- Video RAM: 8kB
- Sound: 4 channels
- Screen: 2.6 inch diagonal, 160×144 pixels, 4 shades of grey





# Game Boy Sound Capabilities

- 2 square wave channels, both with volume envelope and one with the ability to frequency sweep
- 1 4-bit pulse code modulation (PCM) wave channel
- 1 white noise channel, or pseudo-random number generator
- Stereo output, mono outboard speaker
- Similar to NES sound chip



# Comparison of Ways to Preserve Game Boy Music

- Get the original source material from the game's composer
- Record the output of the Game Boy
- Create a ROM file, and play it back through an emulator
- Other?

# Obtain Original from Composer

- About:
  - Songs were typically written in Music Macro Language (MML) or MIDI and then played back via a sound driver
  - Original may have been written in assembly language, in this case the artifact is the code
- Pros:
  - Gives the most accurate representation of the composer's original intent (is this needed?)
- Cons:
  - Difficult or impossible to obtain due to legal and storage issues
  - Doesn't necessarily include all the information required to play back, as it may require a sound driver as well



Koji Kondo, circa 1990, working on the soundtrack to Super Mario World for the Super Famicom.

# Record Output of the Game Boy

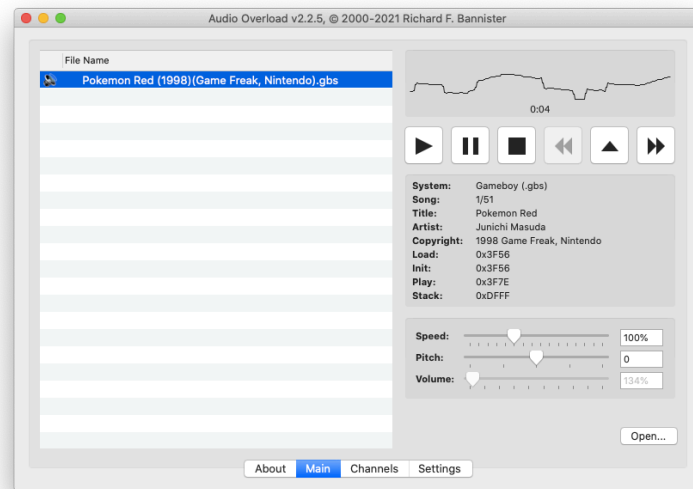
- About:
  - Captures a performance of a song on a particular Game Boy or emulator
- Pros:
  - Easy to play back
- Cons:
  - Doesn't allow visibility into how the song was created
  - Captures only one version of a particular piece, other hardware may sound different



Audio can be recorded via a high-quality line-out jack like this.

# The GBS File Format

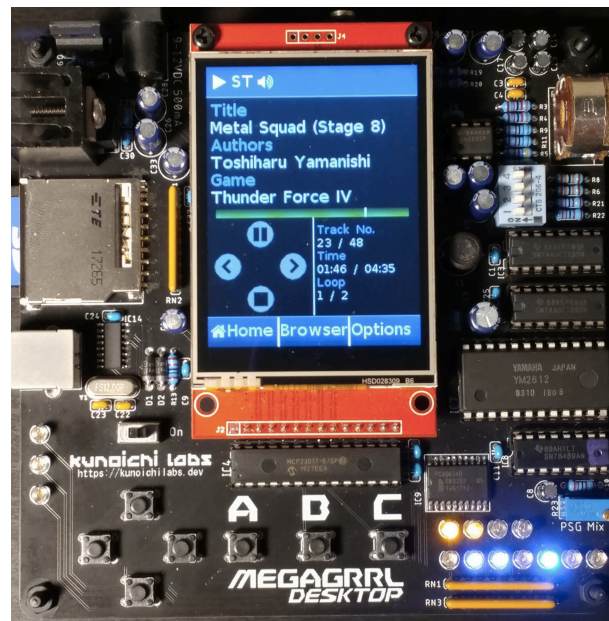
- **About:**
  - Only the sound-producing code of a Game Boy game
- **Pros:**
  - Small file size
  - Allows visibility into technology-specific composition techniques
- **Cons:**
  - Requires emulation of the Game Boy hardware
  - Doesn't allow scrubbing through the file



Playback of a GBS file in Audio Overload.

# The VGM File Format

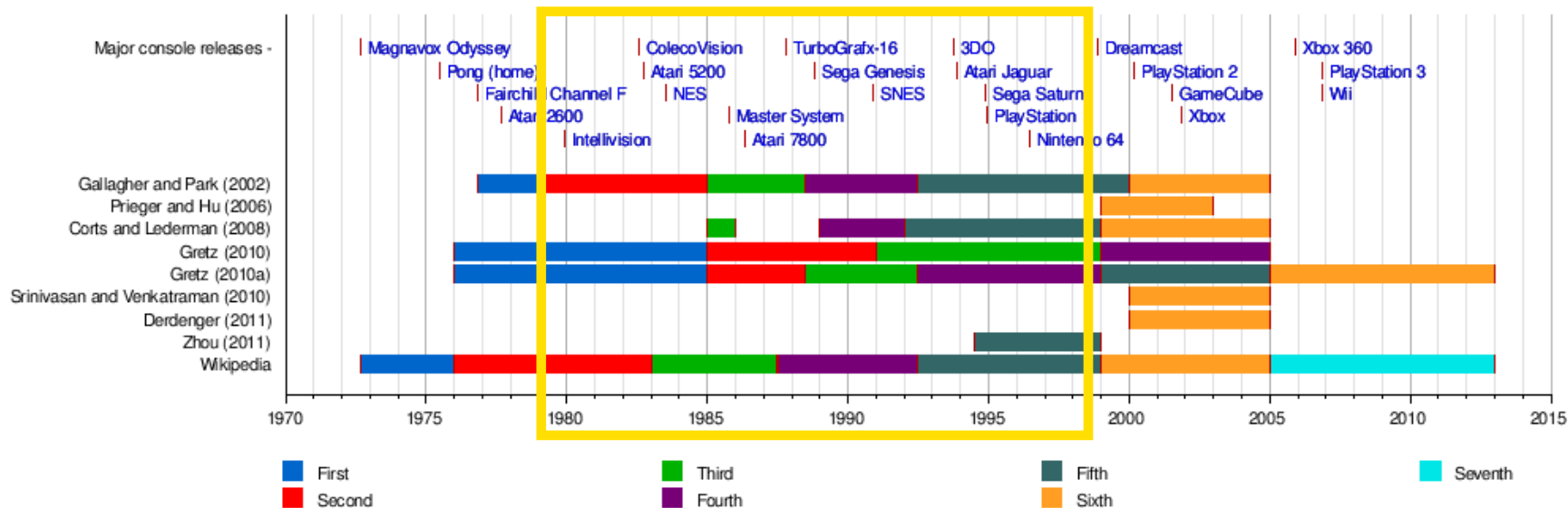
- About:
  - A multi-platform format designed to handle chip-based video game music
  - Consists of 44.1kHz sampled APU registers
  - Used in the [NES music database](#)
- Pros:
  - Allows scrubbing through tracks
  - Allows visibility into compositional techniques that recordings don't
  - Only the APU needs to be simulated
- Cons:
  - Still requires more complex playback technology than recorded audio



MegaGRRL Desktop, a hardware device for playing back VGM files that use the YM2612 chip.

# Preservation Timeline

- These preservation techniques are only necessary for a certain era of video game hardware (late 1970s through late 1990s)
  - Older consoles didn't have powerful enough CPUs to play music
  - Newer consoles had powerful enough CPUs to play recorded music



# It Gets More Complicated

- Some video games have adaptive soundtracks
  - Monkey Island 2: LeChuck's Revenge, 1991
  - Spore, 2008
  - Mini Metro, 2014
  - Ape Out, 2019
- Always will be loss of information when projecting nonlinear medium into a linear format
- How to capture this?





Thank you!