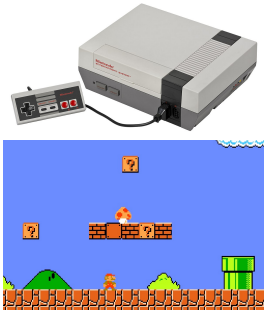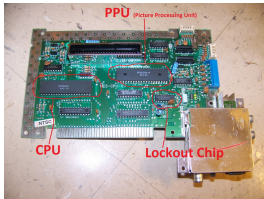# 2: De-make culture

Research journal check-in

NES hardware

Nintendo Entertainment System (NES)

- ► Released in **1983**
- ► Sold as the **Famicom** (Family Computer) in Japan
- ► Nearly **62 million** units sold worldwide
- ► Biggest selling game: **Super Mario Bros**
- ► Credited with reviving the games industry after the **video game crash** of the early 80s

Nintendo Entertainment System (NES)

- CPU: Ricoh 2A03 (closely based on MOS 6502)
- Picture Processing Unit (PPU): Ricoh RP2C02 or RP2C07
- RAM: 2 kilobytes for CPU + 2 kilobytes for PPU
- Cartridge ROM: up to 1 megabyte, but typically less
- Screen resolution: 256×240

Technical limitations

- Around **2270 CPU cycles per frame**
- Only **2 kilobytes** of writable memory to work with
- 6502 instruction set is limited
    - 8-bit integers only
    - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:
    - > 8 bit numbers
    - Multiplication
    - Division
    - Fractional numbers

Graphical limitations

- Display is made up of **sprites** and **background**
- Sprites:
    - Maximum 64 on screen
    - Maximum 8 on the same scanline (horizontal line)
    - 8×8 pixels, 3 colours + transparency
    - Can flip horizontally or vertically
    - No rotation, scaling etc.
- Background:
    - Made of 8×8 pixel tiles
    - 32×32 blocks must share the same 4-colour palette
    - Limitations on types of scrolling

https:
//wiki.nesdev.com/w/index.php/Limitations

Examples of NES games

https://youtu.be/um-GMygsRg4

De-makes

De-makes

"purposedly built as an interpretation of how the game may have been, were it conceived and produced during a previous hardware or software generation"

https://tvtropes.org/pmwiki/pmwiki.php/Main/VideogameDemake

Constrained development task

- Develop a NES de-make of a "modern" game
- **Next week**: give a 5-minute pitch for your de-make
- Make sure you consider **scope** and **technical limitations** carefully
- Focus on a single key mechanic
- Focus on gameplay, not graphics or content

Developing for the NES

Tools

- An **emulator**
  - Recommended: FCEUX
  - http://www.fceux.com/
- An **assembler**
  - Recommended: NESASM
  - https://github.com/edpowley/nesasm/releases
- A **sprite editor**
  - Recommended: YY-CHR
  - https://www.romhacking.net/utilities/119/
- A **text editor**

Live coding videos

- `bit.ly/comp310`
- I expect you to work through these **in your own time**
- Timetabled workshops are mostly for **working on your projects** and getting **support** (although there will also be a bit of taught material)

Let's jump in!

- `http://nintendoage.com/forum/messageview.cfm?catid=22&threadid=7974`
- Download `controller.zip`

Exercise

Modify `controller.asm` so that all of Mario moves left and right, not just the back of his head...